THE

GARDENS' BULLETIN

SINGAPORE

Vol. XV 20th November, 1956

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To be purchased at the Botanic Gardens, Singapore
Price $20; $21 *outside Malaya*

Published by Authority

PRINTED AT THE GOVERNMENT PRINTING OFFICE, SINGAPORE,
BY A. G. BANFIELD, GOVERNMENT PRINTER

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COMMONWEALTH MYCOLOGICAL INSTITUTE
23 JAN 1957

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Croton hirtus an Alien New to Malaya

By JAMES SINCLAIR

I FIRST FOUND *Croton hirtus*, an alien of Tropical America, in Johore on 20th August, 1954, growing by the roadside (17½ mile Johore-Kota Tinggi Road) among grass but not in any quantity. On 21st November, 1954, I again found it, this time in abundance by the Kelantan River near Kota Bahru in sweet potato patches on the sandy river bank. The specimens were sent to Kew and identified by Mr. Lewis L. Forman.

In April 1955, I received specimens of *Croton hirtus* from Selangor, sent by Mr. P. R. Wycherley of the Rubber Research Institute of Malaya for identification. He informs me that it was first collected by Dr. E. D. C. Baptist on 7th July, 1954 at Bukit Rajah Estate, Klang. That specimen is retained by the Rubber Research Institute in their herbarium but subsequent material collected by Wycherley from Bukit Rajah Estate on 22nd April is now preserved in Herb. Singapore. Wycherley states that *Croton hirtus* is frequent throughout many acres here and appears to be spreading as its seeds freely and regenerates in bare areas under rubber on the coastal flats. In fact sodium arsenite has been used to spray it and other vegetation under rubber with effect. He again found it on Midlands Estate near Klang. The material in Herb. Singapore from Sungei Buloh was collected on 10th March, 1955 by Mr. V. K. Bhaskaran Nair while making a survey of vegetation at the Rubber Research Institute Experiment Station. Here it was fairly frequent in sandy soil in association with *Tricholaena rosea*, *Mimosa pudica*, *Centrosema pubescens*, *Passiflora foetida*, *Cyperus compressus* and *Borreria latifolia*.

Croton hirtus occurs in Java and has been there for many years. There is evidence that it was in Malaya much earlier than the

above records indicate. There is one sheet in Herb. Singapore, stamped 30th April, 1936. The label has no data except *Croton sp.* and the printed heading "Herbarium Rubber Research Institute of Malaya".

As *Croton hirtus* is likely to spread and to appear in the other states of Malaya, it would be interesting to know of any further distribution. Since the work in which the original description appeared is available to very few botanists in the region and since none of the Malayan floras mentions it, a description and drawing made from living plants are here appended.

Croton hirtus L'Héritier, Stirpes Nov. 1 (1875) 17 t. 9.

Synonym: C. glandulosus L. var. *hirtus* M.-Arg. in DC. Prodr. 15, 2 (1866) 684.

Erect herb, annual or short-lived, 5–30 cm. high. *Stems* terete, green or often brownish-yellow, sparsely covered with stellate, hispid, 1–2 mm. long hairs. *Leaves* dull and medium green above, paler green beneath, deltoid, ovate-deltoid or slightly rhomboid,

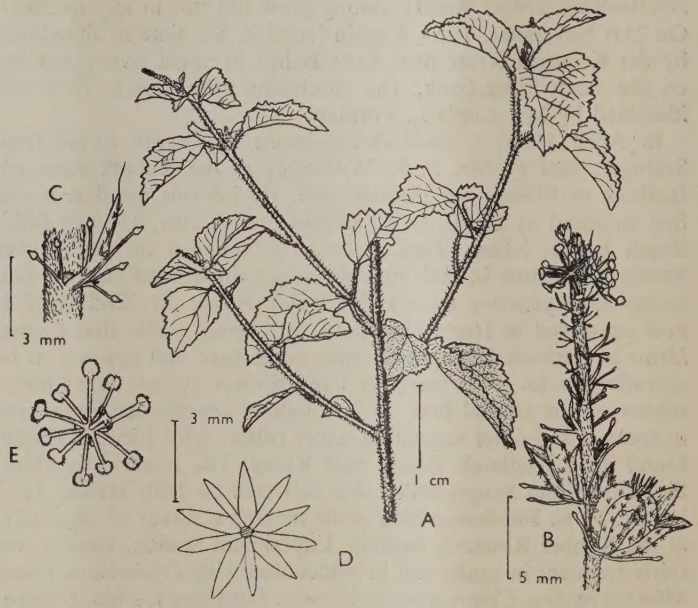

Fig. 1. *Croton hirtus* L'Herit.
A, Upper portion of plant with flowers. B, Inflorescence with male and female flowers. C, Bract and prophylls of male flower. D, Male perianth, inside view, stamens removed. E, Stamens and glands.

pubescent above and below with stellate, hispid hairs 0·5 mm. long, margins doubly crenate-serrate; nerves 5 pairs; length 2·5–6 cm.; breadth 2–5·5 cm.; petiole 1·5–2 cm. long with a pair of filiform, 5 mm. long stipules at the base. *Inflorescene* spike-like, hispid-stellate hairy, the male flowers at the top and female at the base. *Male flowers* 4–5 mm. in diam. in the axil of a trifid, 1–2 mm. long bracteole and two lateral stipular prophylls, the median axis of the bracteole filiform, green, slightly longer than the 2 side branches which are modified as glands, their stalks terete, greenish-white, their glandular heads ampulliform, greenish-yellow; the prophylls 1 mm. long or less, their median axes rudimentary, their two lateral axes similar to those of the bracteole; perianth of 5 outer greenish sepals with a minute gland at the base of each inside, and 5 inner, white, membranous petals; stamens 11, 5 outer, 5 inner and 1 central, 1–2 mm. long; filaments and anthers white. *Female flowers* each on a 1 mm. long stalk, surrounded by 5, unequal, green, foliar, linear-spathulate, laciniate, acute, 4–5 mm. long perianth segments; ovary green, covered with stellate-hispid hairs, subglobose, 5–6 mm. in diam.; style 1–1·5 mm. long, branched at the base into 3 linear segments, the segments again each divided close to the base into 2 linear, brick-red stigmas. *Seeds* 2 mm. in diam., greyish-brown, with a dull, puncticulate surface. **Fig. 1.**

KELANTAN: Kampong Pasir Pekan, Kota Bahru, *Sinclair S.F.N. 40515* (SING, K, E, L, BZF).

SELANGOR: Rubber Research Institute Experiment Station, Sungei Buloh, *Bhaskaran Nair, 10th March, 1955* (SING); Bukit Rajah Estate, Klang, *Wycherley, 22nd April, 1955* (SING).

JOHORE: 17½ mile Johore-Kota Tinggi Road, *Sinclair S.F.N. 40349* (SING, K, L).

Notes on New Guinea Annonaceae, Part I

By JAMES SINCLAIR

THIS PAPER is the result of the examination of some of Carr's New Guinea Annonaceae and certain other type specimens of Annonaceae kindly sent on loan from the Botanisches Museum, Berlin. Four new species are described here, namely *Artabotrys arachnoides*, *Pseuduvaria lignocarpa*, *P. nova-guineensis* and *P. sessilifolia* while eleven new combinations are made.

These combinations include two *Orophea* species transferred to *Alphonsea*, seven *Orophea* species transferred to *Pseuduvaria* and two *Mitrephora* species transferred to *Pseuduvaria*. The result now, is that every single species in *Orophea* mentioned by Diels in Engler's Botanische Jahrbücher volume 49 (1912) pages 157–161 has been transferred to other genera, two to *Alphonsea* and the rest to *Pseuduvaria*. It should be noted that *Orophea aurantiaca* Miq. has already been removed to *Pseuduvaria* by Merrill [see Philipp. Journ. Sc. Bot. 10: 4 (1915) 255] and *O. dielsiana* to *Pseuduvaria* by me [see Gardens' Bull. Singapore 14 (1955) 403].

The differences between *Orophea* and *Pseuduvaria* are clearly defined in the table on page 391 of the Gardens' Bulletin, Singapore, volume 14. *Orophea* has 6–12 miliusoid stamens while in *Pseuduvaria* the stamens are uvarioid and numerous. It is quite obvious, therefore, that something is wrong when Diels states in his key on page 157—"stamens much more than 15." This statement suits *Pseuduvaria* admirably but is absurd for *Orophea*. Apart from the stamens, the other distinguishing characters of Diels' so-called *Orophea* species were in complete agreement with those of the genus *Pseuduvaria* and so the transfer to this genus of these *Orophea* species is effected.

On examining *Orophea stenogyna* and *O. ovata* it was also found they are misfits in the genus *Orophea* and must go into *Alphonsea*. They cannot be placed in *Orophea* since the petals are saccate at the base, and the inner are not mitriform; the stamens too, have apiculate, produced connectives. These are all distinguishing features of *Alphonsea*.

Thanks is due to the Director of the Botanisches Museum, Berlin for the loan of certain types. It is hoped at a later date to publish part 2 of this series but more material has yet to be studied.

SYSTEMATIC PART

Alphonsea ovata (Scheffer) J. Sinclair, **comb. nov.**

Basinym: Orophea ovata Scheffer in Ann. Jard. Buitenz. 1 (1876) 3; Diels in Engl. Bot. Jahrb. 49 (1912) 158.

Specimen, sine numero, collected by Teijsmann, examined (Herb. Berlin).

A. stenogyna (Diels) J. Sinclair, **comb. nov.**

Basinym: Orophea stenogyna Diels in Engl. Bot. Jahrb. 49 (1912) 157.

Type, *Schlechter 17653* examined (Herb. Berlin).

Artabotrys arachnoides J. Sinclair, **sp. nov.**

Ab adhuc speciebus cognitis e Nova-guinea (i.e. *A. inodorus*, *A. camptopetalus* et *A. desmidanthus*) haec species petalis longissimis linearibus differt.

Frutex scandens. *Ramuli* nigrescentes glabri, juniores parce et minute pubescentes. *Folia* coriacea, elliptica, 7–11 cm. longa, 3·5–5 cm. lata, apice et basi acuta in petiolum brevem decurrentia; costa subtus minute adpresso-pubescentes demum glabra; nervi c.7 pares, a costa fere horizontaliter abeuntes, sensim adscendentes, margine duplo-arcuato-conjuncti, graciles sed utrinque conspicui; reticulationes supra distantes paucae subtus densiores. *Pedicelli* 2 cm. longi, glabri. *Sepala* 4–5 mm. longa, ovata, extus parce pubescentia, intus glabra, apice reflexa. *Petala* subaequalia, linearia, plana, apice angustata, basi ferrugineo-tomentosa latiora, in lamina pubescentia, 5–6 cm. longa et 2–3 mm. lata; exteriora 1-nervata. *Stamina* numerosa, 1 mm. longa. *Ovaria* cylindrica, glabra, 1 mm. longa; stigma virgatum leviter falcatum, 1 mm. longum. *Fructus* ignotus. **Fig. 1.**

Nova-Guinea: Isuarava, *Carr 15159* holotypus (Herb. Sing). Forest about 1,530 m. altitude. "Flower yellow-green"; Lala River, *Carr 15992* (Herb. Sing.). About 1,660 m. altitude. "Flowers yellow".

Named *A. arachnoides* from the long, narrow petals which look like a spider on the herbarium sheet.

Mitrephora cilindrocarpa Burck in Nova Guinea 8: 3 (1911) 433 Tab. 69 fig. 1a, b; Diels in Engl. Bot. Jahrb. 49 (1912) 156.

Mitrephora ? Valeton in Bull. Dép. Agric. Ind. Néerl. 10 (1907) 13.

This is certainly not a *Mitrephora* and I am not sure in which genus it should be placed. Flowers are needed. Diels was also of the opinion that it is not a *Mitrephora*.*

* I now find that *M. cilindrocarpa* Burck has been revised by Backer in Blumea 5 (1942) 492 to *Polyaulax cylindrocarpus* (Burck) Back.

Fig. 1. *Artabotrys arachnoides* J. Sinclair.
A, Leafy twig. B, Flowers.

Pseuduvaria beccarii (Scheffer) J. Sinclair, **comb. nov.**

Basinym: Orophea beccarii Scheffer in Ann. Jard. Buitenz. 2 (1885) 18; Diels in Engl. Bot. Jahrb. 49 (1912) 160.

Type, *Beccari 881* examined (Herb. Berlin).

P. costata (Scheffer) J. Sinclair, **comb. nov.**

Basinym: Orophea costata Scheffer in Ann. Jard. Buitenz. 2 (1885) 19; Diels in Engl. Bot. Jahrb. 49 (1912) 158.

Beccari 1872 examined (Herb. Berlin).

P. dolichonema (Diels) J. Sinclair, **comb. nov.**

Basinym: Orophea dolichonema Diels in Engl. Bot. Jahrb. 52 (1915) 184.

Type, Ledermann 8754 examined (Herb. Berlin and Singapore).

P. filipes (Lauterb. et K. Schum.) J. Sinclair, **comb. nov.**

Basinym: Orophea filipes Lauterb. et K. Schum. in Fl. D. Schutzgeb. Süds. (1901) 319; Diels in Engl. Bot. Jahrb. 49 (1912) 159.

Type, *Lauterbach 1127* examined (Herb. Berlin).

P. grandifolia (Warb.) J. Sinclair, **comb. nov.**

Basinym: Stelechocarpus grandifolia Warb. in Engl. Bot. Jahrb. 13 (1890) 306; Lauterb. et K. Schum. in Fl. D. Schutzgeb. Süds. (1901) 315.

Synonym: Mitrephora grandifolia (Warb.) Diels in Engl. Bot. Jahrb. 49 (1912) 155.

Type, *Warburg 20084* examined (Herb. Berlin).

P. lignocarpa J. Sinclair, **sp. nov.**

Inter species Nova-guineenses haec et *P. versteegii* carpella maxima habent. *P. lignocarpa* carpellis minoribus (3·5–4·5 cm. diam.) globosis, floribus multo minoribus, pedicellis brevioribus, foliis multo minoribus distinguitur.

Arbor 8–10 m. alta. *Ramuli* graciles, striati, nigro-brunnei, mox glabri. *Folia* membranacea, glabra, lanceolata vel elliptico-lanceolata, apice acuminata, basi cuneata, 8–17 cm. longa, 2·5–5 cm. lata; nervi 10–12 pares oblique adscendentes, margine obscure conjuncti, supra tenues, subtus valde prominentes; costa subtus minute verrucosa; reticulationes utrinque tenues; petioli 5 mm.-1 cm. longi. *Flores* axillares, 1–4 fasciculati. *Pedicelli* 1 mm. lorgi medio minute unibracteati. *Flores masculi* minuti, (probabiliter nondum maturi) fusco-brunneo-tomentosi. *Sepala* ovata, acuta, 0·5–0·8 mm. longa. *Petala exteriora* subrotundata, obtusa, 1·5–1·8 mm.

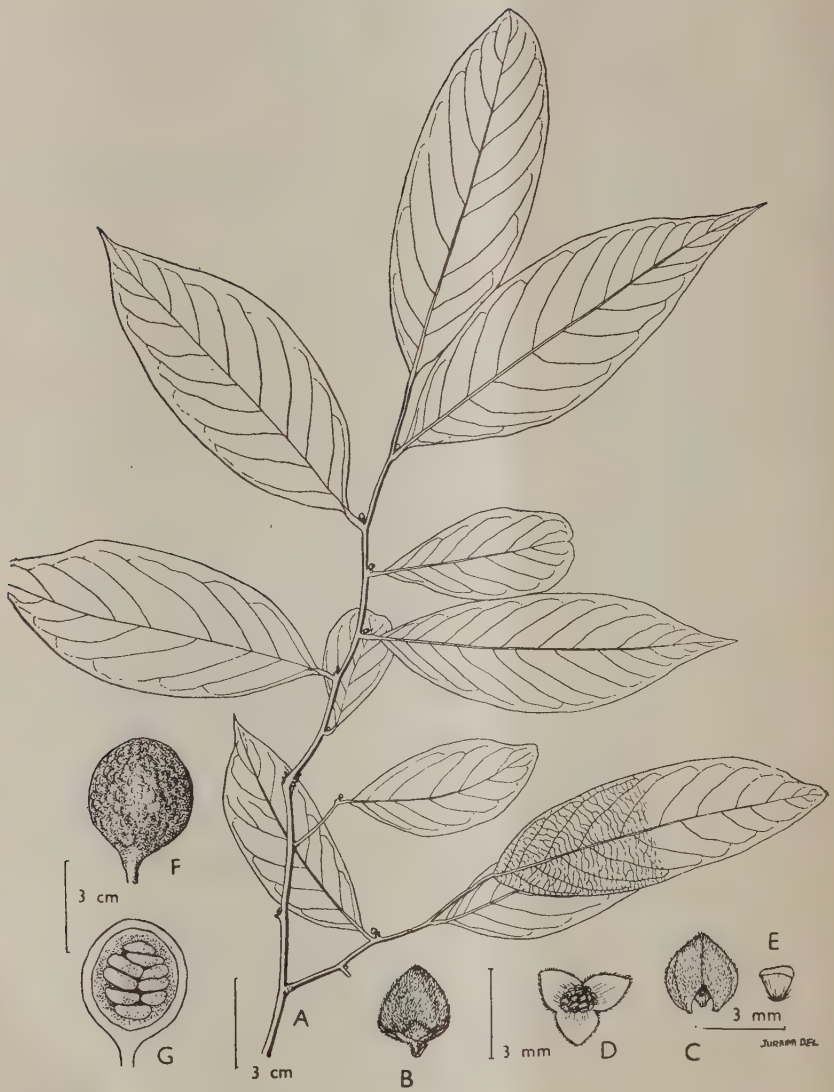

Fig. 2. *Pseuduvaria lignocarpa* J. Sinclair.
A, Flowering twig. B, Flower. C, Inner petals. D, Petals removed, showing stamens. E, Stamen. F, Fruit. G, Fruit, longitudinal section.

longa; interiora mitriformia, breviter unguiculata, 1·5–2 mm. longa. *Stamina* 0·5 mm. longa, 15–20, connectivis truncatis terminta. *Flores feminei* ignoti. *Fructus* cum carpello unico, globosus, minute tomentosus, scabridus vix verrucosus, 3·5–4·5 cm. diam., breviter stipitatus; pericarpium 4 mm. crassum, durum, lignosum. *Semina* c.8 in seriebus duabus disposita. **Fig. 2.**

Nova-Guinea: Isuarava, *Carr 15504* holotypus (Herb. Sing.). "Flowers dull brownish olive outside, deep crimson inside." Altitude c.1,500 m.; Boridi, *Carr 14508* (Herb. Sing.). "Fruit olive green." Altitude c.1,500 m.; Boridi, *Carr 14304* (Herb. Sing.). "Flower dark brown." Altitude c.1,330 m.

The distinguishing features of this species are the small flowers, the large, globose, several-seeded, single carpel with hard woody pericarp, borne on a stalk 5 mm. long and the oblique, steeply ascending nerves of the leaf. The male flowers are probably not quite mature and may become slightly larger. I have not seen female flowers but the fruit has only one carpel.

The fruit is the second largest in the known New Guinea species, that of *P. versteegii* being probably the largest in the genus. The latter measures 6–7 cm. long and 4·5–5·5 cm. broad, but is cylindrical in shape, not globose. There are several described species from New Guinea the fruit of which is as yet unknown.

P. mollis (Warb.) J. Sinclair, **comb. nov.**

Basinym: Goniothalamus mollis Warb. in Engl. Bot. Jahrb. 13 (1890) 306.

Synonyms: Mitrephora mollis Lauterb. et K. Schum. in Fl. D. Schutzgeb. Südsee (1901) 320. *Papualthia mollis* (Warb.) Diels in Engl. Bot. Jahrb. 49 (1912) 142.

P. nova-guineensis J. Sinclair, **sp. nov.**

Inter species cum pedunculis plus quam 5 cm. longis haec ponenda est sed pedunculis crassioribus, foliis basi leviter cordatis differt.

Frutex 3 m. altus. *Ramuli novelli* cum pilis 2 mm. longis dense obtecti. *Folia* tenuiter coriacea, oblonga, apice obtusa, basin cordatam versus paullo angustata, 18–30 cm. longa, 5–8 cm. lata, costa excepta, glabra; costa supra pubescens, insculpta, subtus prominens, parce pilosa; nervi 20–25 pares, supra leviter elevati, tenues, subtus prominentes, a costa angulo 70–90° abeuntes, sensim adscendentes, prope marginem arcuato-conjuncti; reticulationes utrinque distinctae; petioli 3–5 mm. longi, setosi. *Pedunculi*

6–7 cm. longi, axillares, extremo in 2–3 pedicellos, 2–3 cm. longos, medio minute uno-bracteatos divisi. *Flores* hermaphroditi (an semper?). *Sepala* 2–3 mm. longa, triangularia, acuminata, extus pubescentia, intus glabra. *Petala exteriora* 7 mm. longa, membranacea, ovata, reticulata, apice acuta, basi angustata vix unguiculata, marginibus pubescentia; *petala interiora* 1 cm. longa, coriacea, mitriformia, brevissime unguiculata, extus puberula, intus fibrillis succulentis glandulosis obtecta. *Stamina* 0·5 mm. longa, apice plana. *Ovaria* 3, dense strigosa, 1 mm. longa, stigmatibus sessilibus terminata. *Fructus* ignotus. **Fig. 3.**

Nova-Guinea: Kokoda, *Carr 16186* holotypus (Herb. Sing.). "Flowers dark brown." Altitude c.400 m.

A large leaved species with long peduncles. *P. dolichonema*, *P. filipes*, *P. sessilifolia* and the present species have longer peduncles than any of the other New Guinea species. Those of *P. dolichonema* are the longest in the genus, 20–30 cm. long or even more, those of *P. sessilifolia* 7–10 cm., the present species 6–7 cm., and *P. filipes* about 5 cm. In *P. nova-guineensis* the leaves are slightly cordate at the base. The flower is larger than in most New Guinea species and the inner petals have numerous short, thread-like glands. Only one mature flower was available for examination and it was found to be hermaphrodite. It had numerous fertile stamens and three ovaries. Usually *Pseuduvaria* has pistils in one flower and stamens in another but often there are staminodes or one or two partially fertile stamens in a female flower.

P. pulchella (Diels) J. Sinclair, **comb. nov.**

Basinym: Orophea pulchella Diels in Engl. Bot. Jahrb. 49 (1912) 159.

Type, *Schlechter 17057* examined (Herb. Berlin).

P. rhytidophylla (Diels) J. Sinclair, **comb. nov.**

Basinym: Orophea rhytidophylla Diels in Journ. Arn. Arb. 20 (1939) 74.

Type examined, *Brass 6736* (Herb. Berlin).

P. sessilifolia J. Sinclair, **sp. nov.**

In Nova-guinea duae species tantum cum pedunculis longissimis adhuc cognitae sunt, scilicet *P. dolichonema* et *P. sessilifolia* sed ab hac cum pedunculis 20–30 cm. longis, ab illa (*P. sessilifolia*) pedunculis 7–10 cm. longis, foliis caudatis sessilibus differt.

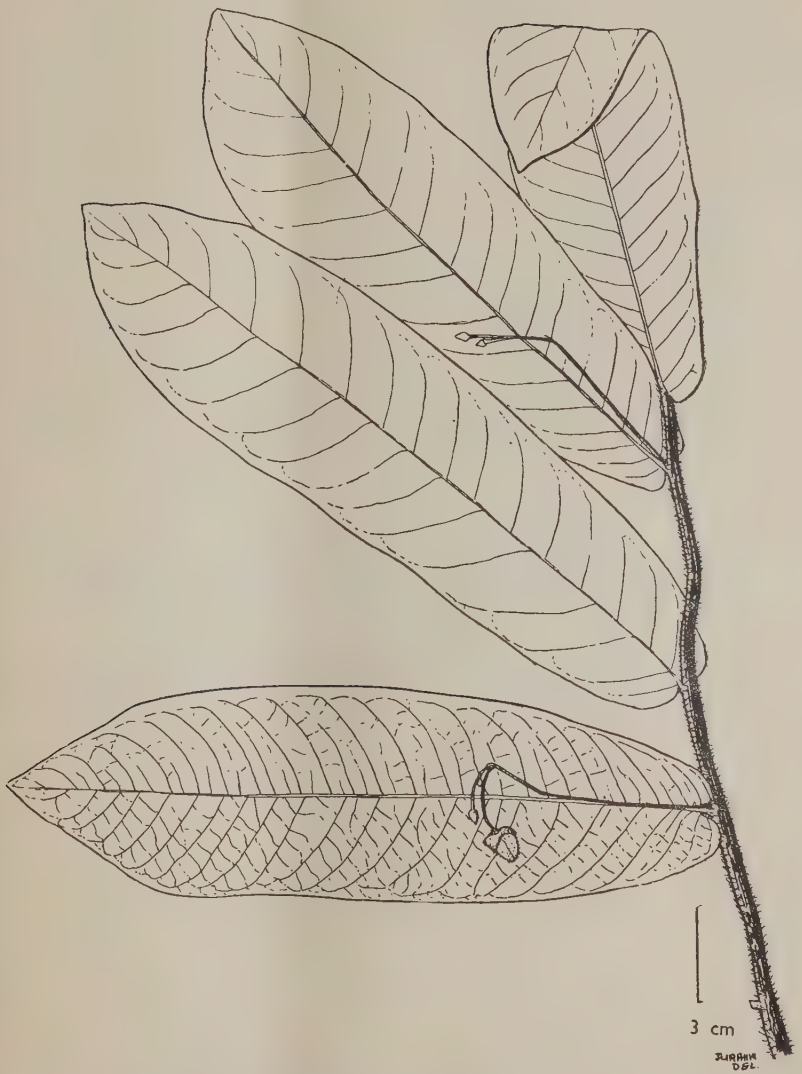

Fig. 3. *Pseuduvaria nova-guineensis* **J. Sinclair.**
Flowering twig.

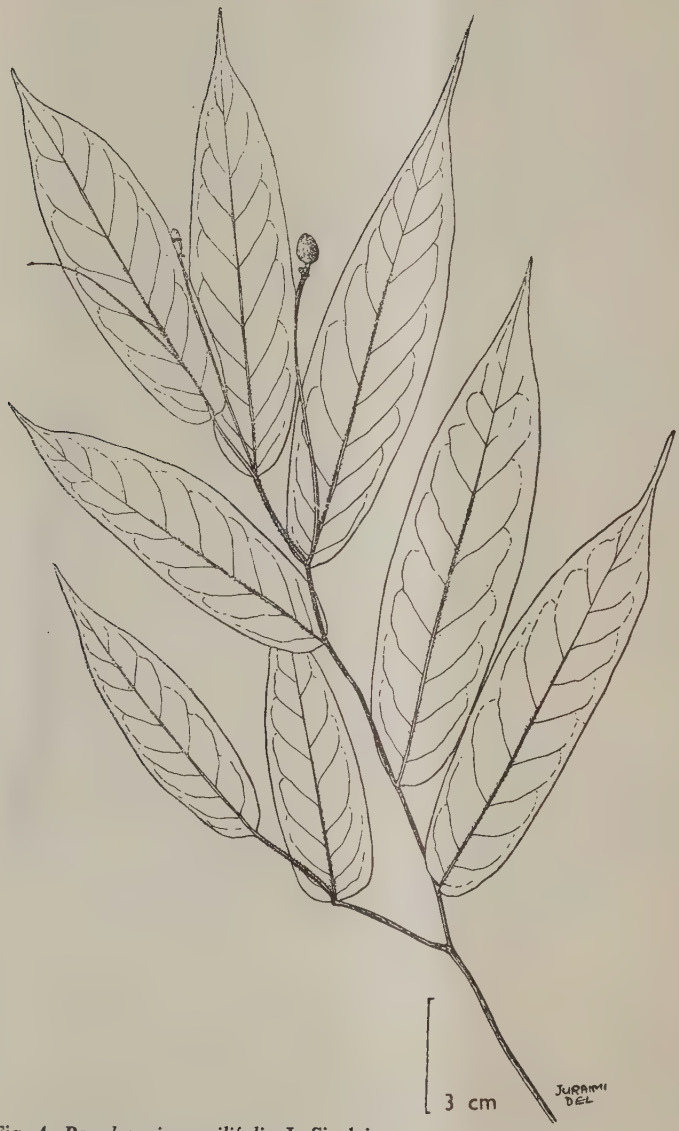

Fig. 4. *Pseuduvaria sessilifolia* J. Sinclair.
Flowering and fruiting twig.

Frutex 3 m. altus. *Ramuli* graciles, flexiles, juventute pilis fulvis erectis 0·5 mm. longis tecti, mox glabri, nigrescentes. *Folia* membranacea, lanceolata, sessilia, apice acuta, basi rotundata emarginata, subtus secus costam tantum parce pilosa, in altera parte glabra, 9–14 cm. longa, 2–3·5 cm. lata; nervi 10–12 pares sensim adscendentes, 3–5 mm. margine arcuato-conjuncti, supra tenues, subtus conspicui; reticulationes subtus tantum conspicui, laxae dispositae. *Pedunculus* 7–10 cm. longus, pedicellis duobus 5 mm. longis terminatus. *Flores masculi: sepala* membranacea, ovata, vix 1 mm. longa; *petala exteriora* membranacea, rotundata, minute puberula, 2 mm. diam., *petala interiora* coriacea, mitriformia, unguiculata in partibus cohaerentibus pubescentia, 4 mm. longa; *stamina* 0·5 mm. longa, vertice plana. *Flores feminei*: *petala* et *sepala* ut in masculo; *stamina* pauci partim fertilia; *ovaria* 3–4, strigosa, 1·3 mm. longa, stigmatibus subcapitatis. *Fructus* juvenilis: carpella 3–4; unum carpellum tantum maximum, 6 mm. diam., minute incano-tomentosum, breviter stipitatum, altera carpella minima, conformia, probabiliter cauduca. **Fig. 4.**

Nova-Guinea: Isuarava, *Carr 15763* holotypus (Herb. Sing.). Altitude c.1,160 m.

The fruit is very young but it seems that one carpel will develop at the expense of the rest which will fall. There were several partially fertile stamens and one or two which had larger connectives and looked almost normal in the female flower dissected.

P. silvestris (Diels) J. Sinclair, **comb. nov.**

Basinym: Orophea silvestris Diels in Engl. Bot. Jahrb. 49 (1912) 160.

Type, *Schlechter 17450* examined (Herb. Berlin).

Miscellaneous Notes on Annonaceae

By James Sinclair

In this short paper I make one new combination, *Meiogyne subsessilis* (Ast), one new name, *Mitrella dielsii*, and one new variety, *Goniothalamus macrophyllus* var. *siamensis*. These concern Annonaceae from Indo-China, Borneo and Siam respectively.

Meiogyne subsessilis (Ast) J. Sinclair, **comb. nov.**

Basinym: Cyathocalyx subsessilis Ast in Suppl. Flore Générale de L'Indo-Chine Fasc. 1 (1938) 90.

I have examined *Poilane 10600*, type of *Cyathocalyx subsessilis* Ast, locality massif de Dong-che, Annam. The specimen was kindly loaned from the Museum National D'Histoire Naturelle, Paris. The appearance of the leaves and structure of the flower show that it is not a *Cyathocalyx* but a *Meiogyne*.

Mitrella dielsii J. Sinclair, **nom. nov.**

Synonym: Melodorum beccarii Diels in Notizblatt 11 Nr. 102 (1931) 85 non *Melodorum beccarii* Scheff. in Ann. Jard. Buitenzorg 2 (1885) 24 = *Mitrella beccarii* (Scheff.) Diels in Engl. Bot. Jarb. 49 (1912) 149.

Climber. Twigs at first minutely dark chocolate-puberulous, later glabrous and black, finely striate. *Leaves* coriaceous, elliptic or oblong, minutely puberulous above, tomentulose beneath, apex acuminate, base rounded; midrib sunk above, prominent beneath; main nerves 10–11 pairs, with secondary pairs between them, very faint above, fine but visible beneath; reticulations not visible above, fine and faint beneath, forming a close network; length 7–17 cm.; breadth 3·5–6·5 cm.; petiole 1–1·7 cm. long. *Pedicels* 4 mm. long with a basal and median bract. *Sepals* connate-triangular, apiculate, dark rusty-tomentose outside, glabrous inside, 3–4 mm. in diam. *Outer petals* 2·5 cm. long and 3–4 mm. broad, similar in tomentum to the sepals, broadly ovate to rotundate, with a central vein, best seen from the inside and a shallow cavity at the base inside; *inner petals* 4·5 mm. long and 3–4 mm. broad. *Stamens* 2·5 mm. long. *Ovaries* 2·5 mm. long, glabrous. *Carpels* (not mature) very verrucose, oblong, minutely dark rusty-tomentose, 2–2·5 cm. long and 1·5 cm. broad; stalk 5 mm. long or over. **Fig. 1.**

Borneo: Sarawak prope fl. Igan, *Beccari 3899* (FI.) holotype.

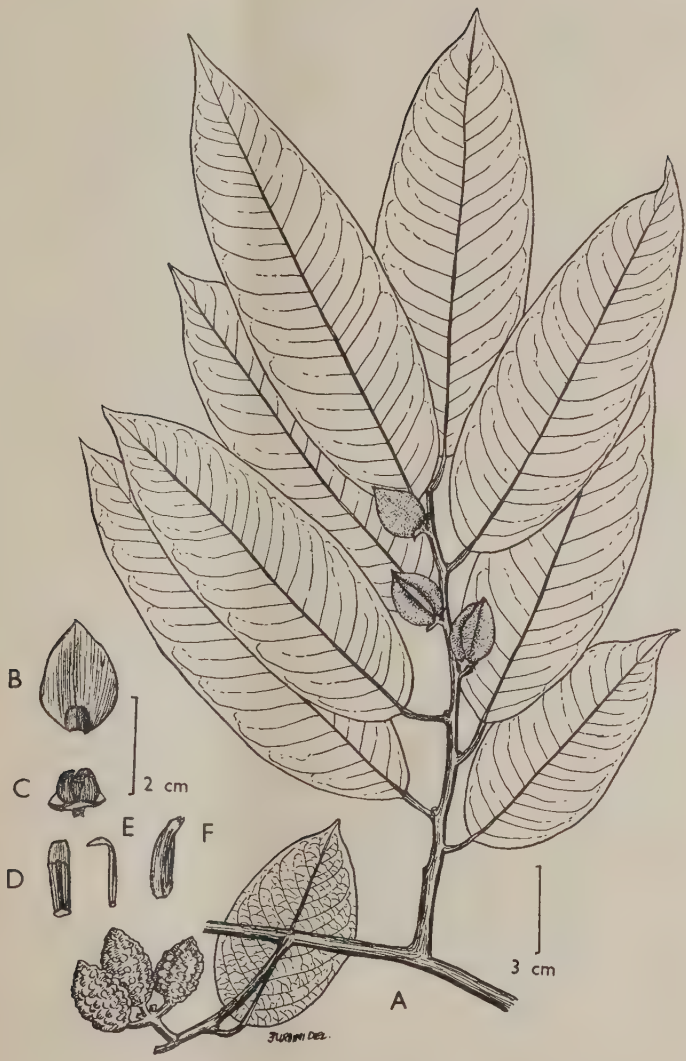

Fig. 1. *Mitrella dielsii* J. Sinclair.
A, Flowering and fruiting twig. B, Outer petal. C, Calyx and inner petals. D, Stamen, front view. E, Stamen side view. F, Gynoecium.

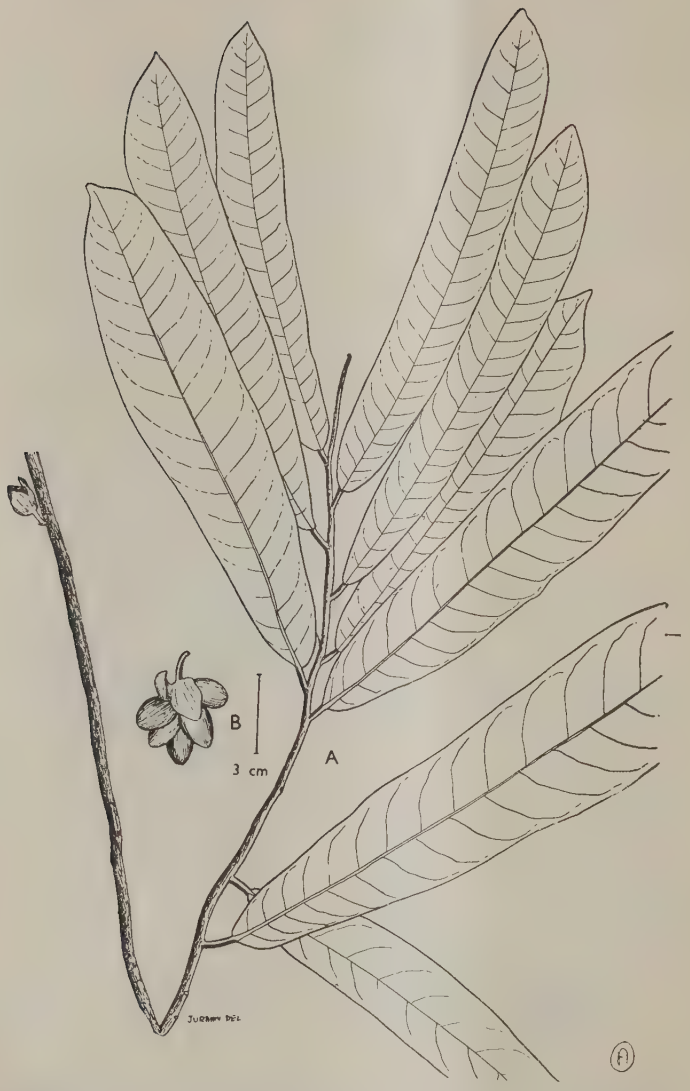

Fig. 2. *Goniothalamus macrophyllus* (Bl.) Hk. f. et Th. var. *siamensis* J. Sinclair.
A, Leafy twig. B, Fruit.

The name *Melodorum beccarii* has already been used for a New Guinea species and cannot be used for the present if one is to place *Beccari 3899* in *Mitrella*. The flowers of *M. dielsii* are like those of *M. kentii* but larger. The leaves and fruit are like those of *Pyramidanthe prismatica*.

Goniothalamus macrophyllus (Bl.) Hk. f. et Th. var. **siamensis** J. Sinclair, **var. nov.**

A typo foliis elongato-oblongis, angustioribus, interdum falcatoideis differt.

Folia basi obtusa, 16–22 cm. longa, 2·5–4·5 cm. lata. **Fig. 2.**

SIAM: Nakawn, Sritamarat, Khao Luang, *T. Smitinand 821* (BKF.), altitude 800 m., 2nd August, 1951.

Shrub 2–3 m. high. Common on slope in evergreen jungle, fruit oblique, obconical, ripening red-orange. A medicinal plant locally used for indigestion. Also numbered Royal Forest Dept., Flora of Thailand *7392*.

Two New Malayan Species, Justicia johorensis and Petraeovitex wolfei

By James Sinclair

Justicia johorensis J. Sinclair, **sp. nov.**

Species ex affinitate *J. pubiflorae* Cl. a qua foliis pubescentibus minoribus, bracteis apice acutis (nec rotundatis nec retusis) differt.

Herba c.60 cm. alta ad nodos radicans. *Radices* graciles 6–9 cm. longae. *Caules* teretes minute adpresso-pubescentes cum internodis 6–10 cm. longis. *Folia* membranacea ovata vel ovato-oblonga, supra atro-viridia, subtus griseo-viridia utrinque molliter pubescentia, apice acuta, basi rotundata vel acuta, saepe inaequilateralia; 5–10 cm. longa, 2–3·5 cm. lata; nervi 8–9 pares valde curvati, margine conjuncti, supra levissime visibiles, subtus prominentes; reticulationes supra non distinctae, subtus laxae et prominentes; petioli 1–3 cm. longi, pubescentes supra canaliculati. *Spicae* laterales axillares, 7–10 cm. longi. *Bracteae* foliaceae late ovato-orbiculares utrinque molliter pubescentes, laxe reticulatae, basi angustatae, apice abrupte acutae, 1·5 cm. longae, 9 mm. latae cum costa prominenti, purpurea. *Bracteolae* pubescentes ciliatae acutae 6 mm. longae. *Sepala* linearia acuta ciliata 5 mm. longa. *Corolla* 1·5 cm. longa alba extus pubescens, labrum posticum 3-nervatum minute bidentatum, labrum anticum purpureo-guttatum tridentatum, dente mediano obtuso, alteris dentibus acutis. *Stamina* 4, duo interiora 4 mm. longa, duo exteriora 6 mm. longa. *Stylus* albus filiformis 1 cm. longus supra glaber basali tertia parte ciliatus; stigma bifidum. *Ovarium* 2 mm. longum elongatum, basi leviter tumidum. **Fig. 1.**

Johore: Sungei Ayer Hitam Besar, Gunong Pulai, *Sinclair S.F.N. 39619* (SING., K.) holotype; Gunong Pulai, *Md. Nur S.F.N. 7771* (SING.); Sedenak *Ridley 13486* (SING.); Kukub on the Tempayang River, *Ridley 13311* (SING.); Sungei Buloh Kasap, Mawai-Jemaluang Road, *Corner, 5th January, 1936* (SING.).

A herb in shade in lowland forest.

Petraeovitex wolfei J. Sinclair, **sp. nov.**

Species ex affinitate *P. scortechinii* et *P. bambusetorum*; a priore foliis glabris inflorescentiae bracteis omnino simplicibus distinguitur; ab altera calyce duplo longiore latioreque recedit.

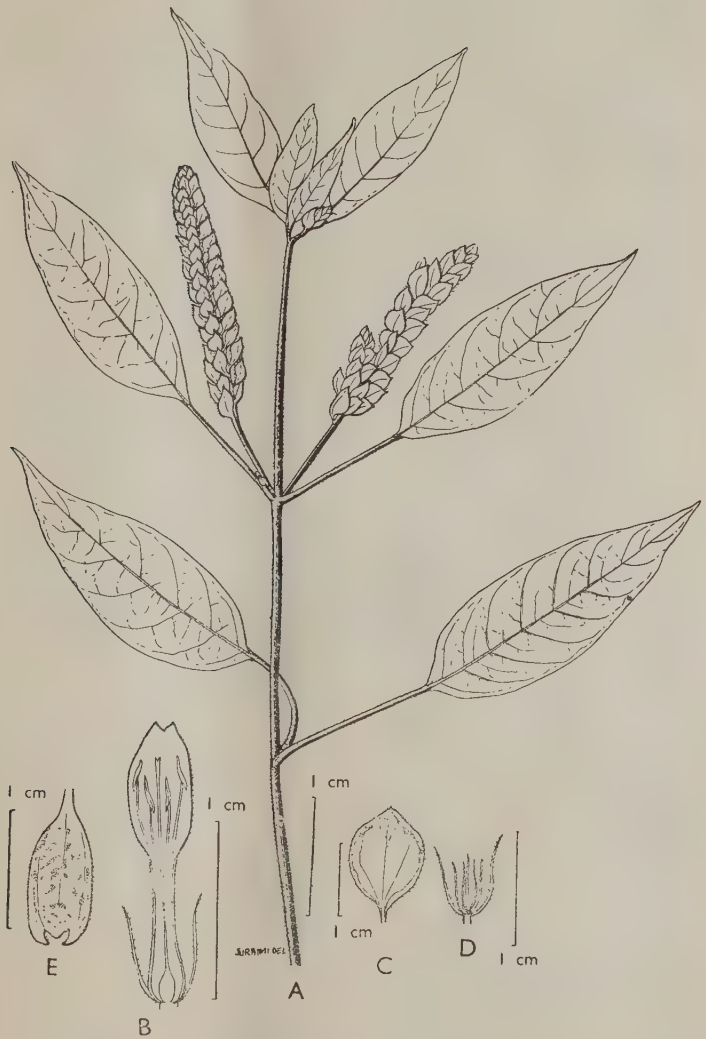

Fig. 1. *Justicia johorensis* J. Sinclair.
A, Flowering stem. B, Longitudinal section of flower. C, Inflorescence bract. D, Calyx and bracteoles. E, Lower lip of corolla.

Planta lignosa scandens. *Folia* membranacea, glabra trifoliolata; petioli 6 cm. longi; foliola elliptica, 9–17 cm. longa, 4–8 cm. lata, basi acuta, apice acuminata; nervi 4–6 pares, patentes, supra prominuli, subtus prominentes; reticulationes laxae utrinque distinctae; petioluli 6 mm.–1·8 cm. longi. *Inflorescentia* speciosa, omnino aurea, pendula, ad 50 cm. longa; ramuli decussati 2–5 cm. longi, in cymis dichotomis terminati; bracteae foliaceae 8 mm.–3 cm. longae; pedicelli 3 mm. longi. *Calyx* 1·8–2 cm. longus, puberulus, leviter falcatus in 5 lobis 2/3-partitus; lobi post anthesin accrescentes, patentes, reticulati, mucronulati. *Corolla* falcata, mox decidua, quam calyx bracteaeque pallidior, 2·5 cm. longa, apice 5-lobata; lobi obtusi 4–5 mm. longi, unus lobus antice, duo postice dispositi. *Stamina* 4, a corollae tubo non exerta, duo 1·2 cm. longa, duo 1 cm. longa. *Stylus* filiformis, 2 cm. longus, stigma bilobatum. *Ovarium* viride puberulum oblongum, 3 mm. altum, primum apice obtusum deinde 4-lobatum. **Fig. 2.**

KEDAH: Selambau, Jeniang Road, 10¾ milestone, *Wolfe* and *Kadir S.F.N. 21452* (SING.) holotype; 48th mile Jeniang Road, *Kiah S.F.N. 35972* (SING.).

TRENGGANU: Bukit Bauk Forest Reserve, Dungun, *Sinclair S.F.N. 39901* (SING.).

Named after Dr. E. D. B. Wolfe, Deputy Director, Medical Services, Federation of Malaya.

It was introduced into the Botanic Gardens, Singapore by Mr. J. W. Ewart in 1939 who obtained the plant from Dr. Wolfe. It still flourishes in the Gardens and is a handsome climber, free-flowering, with long, pendulous, yellow inflorescences.

Fig. 2. *Petraeovitex wolfei* J. Sinclair.
A, Leaf. B, Inflorescence. C, Older inflorescence with enlarged calyx. D, Young calyx. E, Enlarged calyx section showing ovary. F, Corolla. G, Corolla in longitudinal section.

Additions to the Flora of Singapore and New Localities in Singapore for some Plants thought to be Extinct—Part II

By James Sinclair

This paper is a continuation of a previous one with the same title, published in the Gardens' Bulletin, Singapore, Vol. 14, Part 1, August 1953. In the present one, eighteen species are listed as new to Singapore. Five of these are new to Malaya as well, namely:—*Halorrhagis chinensis*, *Stemodia verticillata*, *Cymodocea isoetifolia*, *C. rotundata* and *C. serrulata*. *Halorrhagis* is very probably native, *Stemodia* is introduced and the three *Cymodocea* species are native. Of the eighteen, twelve are at least native and the other six introduced.

Singapore island has been well explored botanically for many years and it is somewhat surprising that we should still find twelve more native species, seven of which are forest plants. It is not surprising to record six introduced plants and more can be expected to arrive in future years with the ever-extending cultivation.

On the other hand many of our native plants must disappear, unfortunately, as more and more land is used for building houses, aerodromes, military barracks, quarries and factories. A considerable area has been cleared of vegetation and built on since Part I of this paper was written. It is gratifying, however, that the few plants, mentioned in the second part of this paper are not yet extinct and though rare, are still part of our local botanical heritage.

A new name, *Ardisia rudis* J. Sinclair, is given for the Malayan *A. ferruginea* Mez, there being already another plant called *A. ferruginea* H. B. & K.

I—New Records for Singapore

Shorea collina Ridley in Agric. Bull. Straits & Fed. Malay States 9, 5 (1910) 182.

Kruing Path, Bukit Timah Forest Reserve, *Sinclair S.F.N. 39650,* 27th May, 1953.

A young tree, sterile, determined by J. Wyatt-Smith, Forest Reserve Institute, Kepong. Not previously recorded for Singapore but known from Trengganu, Pahang and Johore.

Waltheria indica L. Sp. Pl. (1753) 673.

Sandy seashore by path, Changi, *Sinclair S.F.N. 40016*, 5th September, 1953. Native. Very rare.

Not previously recorded from Singapore. In Malaya this plant grows on sandy sea coasts so it is not surprising that it should occur at Changi.

Dapania scandens Stapf in Hooker's Icon. Pl. (1891) T. 1997.

Kruing Path, Bukit Timah Forest Reserve, *Sinclair S.F.N. 39648*, 27th May, 1953; 15th mile Jurong, *Corner s.n.*, November 1932.

Not previously recorded from Singapore. The plant is probably extinct now in its Jurong locality where the forest has been cleared. It still flourishes in Bukit Timah but is very rare. The Singapore Herbarium contains specimens collected in Kelantan, Perak, Trengganu, Selangor, Pahang and Johore.

Desmodium laburnifolium DC. Prodr. 2 (1825) 337.

In coco-nut plantations between Tuas and Tanjong Gul, *Sinclair 7438*, 21st May, 1953; Kampong Melayu, Jalan Eunos, *Corner s.n.*, July 1944.

Not native. The only other record for Malaya is *Ridley 15434*, Kota Tinggi, Johore.

Pygeum griffithii Hk. f., F.B.I. 2 (1878) 322.

Pipeline, Seletar Forest, *Sinclair S.F.N. 39615*, 9th May, 1953; Nee Soon Rifle Range, Seletar Forest, *Sinclair S.F.N. 40263*, 23rd April, 1954.

Not previously recorded for Singapore but is found in Johore, Malacca and Selangor.

P. lanceolatum Hk. f., F.B.I. 2 (1878) 319.

Seletar Forest beyond No. 2 rifle range, *Sinclair S.F.N. 40272*, 1st May, 1954.

Not previously recorded for Singapore although there is a specimen, *Cantley*, Singapore, without date, locality or number in Herb. Sing. The plant is widely distributed throughout lowland forests in Malaya, so again it is not surprising to find it in Singapore.

Halorrhagis chinensis (Lour.) Merr. in Trans. Am. Phil. Soc. n.s. 24 (1935) 290.

Synonym: H. scabra (Koenig) Benth. var. *elongata* Schindl. in Engl. Pflanzenreich 23 (1905) 28.

Sri Taman, opposite Pulau Sarimbun, *Sinclair S.F.N. 40276*, 4th May, 1954.

First record for Singapore and for Malaya. Professor C. G. G. van Steenis, who saw my specimens, *S.F.N. 40276*, thinks that this plant is native and not introduced. It is a small herb, easily overlooked and hence rarely collected. It occurs throughout Malaysia, though the localities are wide apart. It should be looked for in other parts of Malaya.

Ardisia rudis J. Sinclair, **nom. nov.**

Synonym: A. ferruginea Mez in Pflanzenreich 4, 236 (1902) 108.

Swamp forest in deep shade. Off road leading to No. 1 rifle range, Nee Soon, Seletar Forest, *Sinclair S.F.N. 40278*, 8th May, 1954. Apparently rare.

Not previously recorded for Singapore. It has been found in several places in Johore in swampy forest. The name *A. ferruginea* cannot be used on account of the earlier *A. ferruginea* H. B. & K., Nov. Gen. et Sp. 3 (1818) 244.

Lindernia sessiliflora (Benth.) Wettst. in Engl. & Prantl, Naturl. Pflanzenfam. 4, 3b (1891) 79.

Government House Domain, *G. H. Addison s.n.*, 1st July, 1949; Botanic Gardens, *M. R. Henderson s.n.*, 12th December, 1940; *J. W. Purseglove 4022*, 7th February, 1955.

Not previously recorded for Singapore and not in Ridley's Flora. It is mentioned by Henderson as a weed in grass in gardens, Malayan Wild Flowers 2 (1950) 333 but no localities are given. Since the above specimens were collected, it is now widespread over the island. There is one record in Herb. Sing. from Selangor and doubtless it can now be found throughout Malaya.

Stemodia verticillata (Mill.) Boldingh, Zakfl. Landbouwstr. Java (1916) 165.

Nursery, Botanic Gardens, *G. H. Addison s.n.*, 24th January, 1941; Assistant Botanist's Quarters, *C. X. Furtado*, 3rd June, 1942; Director's Garden, Botanic Gardens, *J. W. Purseglove 4023*, 7th February, 1955.

A weed in the Botanic Gardens, new to Singapore and Malaya. It has been known for some time but the records have not been published and it is not mentioned in Ridley's Flora.

Andrographis paniculata Nees, Wall. Pl. As. Rar. 3 (1832) 116.

Private garden Changi Road, *B. K. Sahib s.n.,* 7th June, 1926; Pulau Damar Laut, *Sinclair*, 1st November, 1948.

Also a weed in the Botanic Gardens, but not previously recorded from Singapore. There are specimens from Penang, Province Wellesley and Perak in Herb. Sing.

Litsea gracilipes Hk. f., F.B.I. 5 (1886) 159.

Path leading to rifle range, Nee Soon, Seletar Forest, *Sinclair S.F.N. 40274*, 1st May, 1954.

No previous record for Singapore but has been found in peat or fresh water swamp forest in Perak, Selangor, Malacca, Pahang and Johore.

Quercus sundaica Bl. in Verh. Bat. Genoots. 9 (1825) 216.

11½ miles Mandai Road, *Sinclair S.F.N. 40203*, 20th February, 1954. Sterile. One tree seen.

First record for Singapore although widely distributed in Malaya and extending to Java, Sumatra and Borneo.

Cymodocea isoetifolia Aschers. in Sitzb. Ges. Naturf. Fr. Berlin (1867) 3.

Sandy, muddy substratum near low water, Tanah Merah Besar, *Sinclair S.F.N. 39509*, 14th March, 1953 and *S.F.N. 40537*, 6th March, 1955.

New record for Singapore and Malaya. Determined by M. Jacobs, Leiden. Growing in association with *Cymodocea serrulata*, *C. rotundata*, *Thalassia hemprichii* and *Halophila spinulosa*. **Fig. 1C** and **D.**

C. rotundata (Ehrb. & Hempr.) Aschers. & Schweinf. in Sitzb. Ges. Naturf. Fr. Berl. (1870) 84.

Seashore below half tide, Telok Paku, *Sinclair S.F.N. 40527*, 17th February, 1955 and seen at Tanah Merah Besar, 6th March, 1955. At Telok Paku in association with *Thalassia hemprichii* and *Enhalus acoroides.*

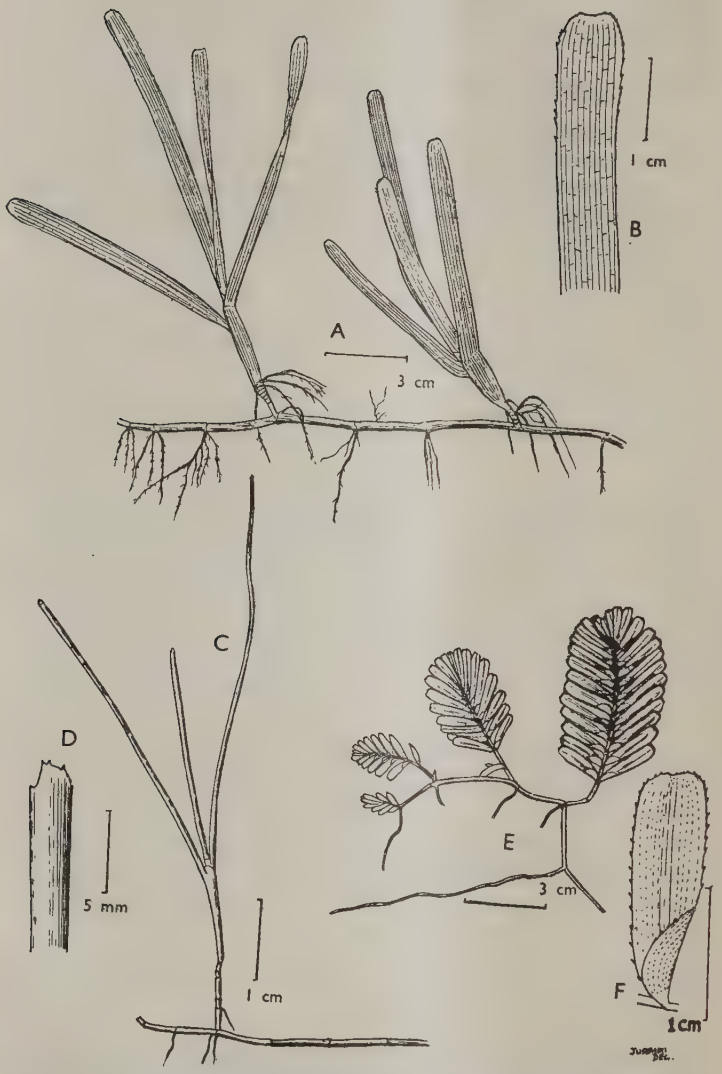

Fig. 1. A, *Cymodocea serrulata* leafy shoot. B, Leaf tip magnified. C, *Cymodocea isoetifolia*, leafy shoot. D, Leaf tip magnified. E, *Halophila spinulosa*, leafy shoot. F, Leaf magnified.

New record for Singapore and Malaya. Confirmed by M. Jacobs, Leiden. **Fig. 2.**

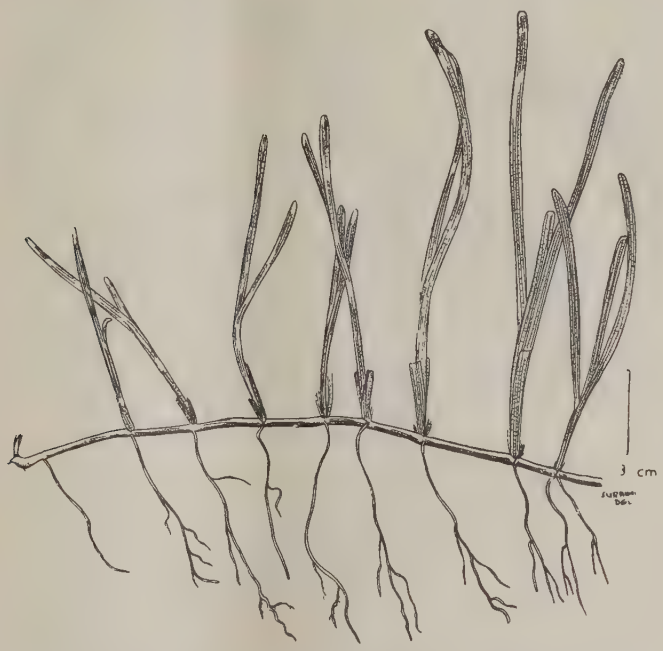

Fig. 2. *Cymodocea rotundata* (Ehrb. & Hempr.) Aschers & Schweinf. Leafy shoot.

C. serrulata (R. Br.) Aschers. & Magnus in Sitzb. Ges. Naturf. Fr. Berl. (1870) 84.

Tanah Merah Besar, *Sinclair S.F.N. 39508*, 14th March, 1953 and *S.F.N. 40536*, 6th March, 1955; north end of Kampong Pulau Samulun, *Sinclair S.F.N. 38581*, 31st July, 1949.

New record for Singapore and Malaya. Determined by M. Jacobs, Leiden. The Pulau Samulun specimen, *Sinclair S.F.N. 38581* was wrongly determined as *Thalassia hemprichii* and recorded in Gardens' Bull. Sing. 14 (1953) 35. *Thalassia hemprichii* however does occur in Singapore and is common at Telok Paku, *Sinclair S.F.N. 40526*, 17th February, 1955, determined by M. Jacobs and was also seen at Tanah Merah Besar in association with the other *Cymodocea* species and *Halophila spinulosa*. **Fig. 1A** and **B.** and **Fig. 3.**

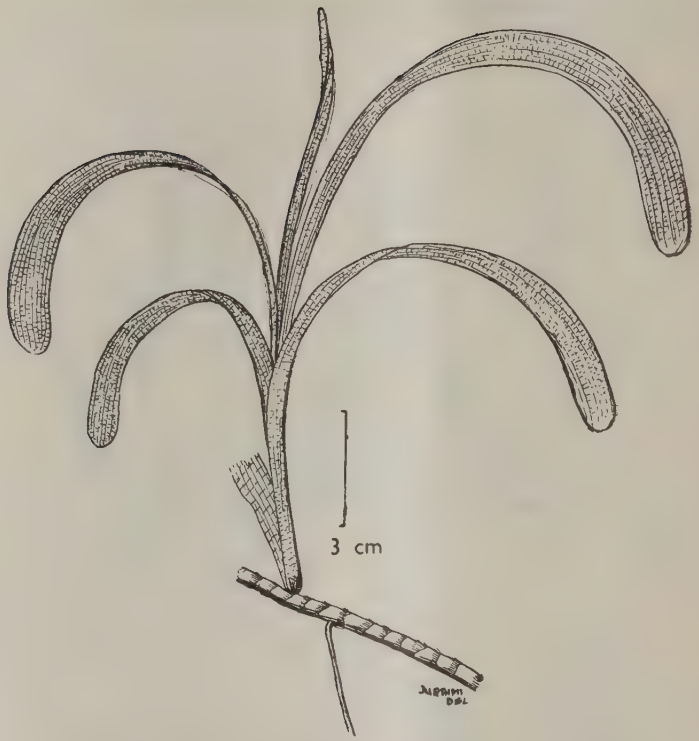

Fig. 3. *Thalassia hemprichii* Aschers.
Leafy shoot.

Cyperus sanguineolentus Vahl ssp. **cyrtostachys** (Miq.) Kern in Reinwardtia 3, 1 (1954) 57.

Marshy ground at fish ponds, off 9¾ mls. Changi Road (north side), *Sinclair S.F.N. 40538*, 10th March, 1955.

First record for Singapore. Previous records are from Kedah, Penang, Perak, Pahang, Selangor and Negri Sembilan. A weed of cultivation.

Sorghum propinquum (Kunth) Hitch. in Lign. Sci. Journ. 7 (1929) 249.

By canal at 6th mile between Bukit Timah Road and Dunearn Road, *Sinclair S.F.N. 40373*, 24th September, 1954.

Not previously recorded for Singapore. Introduced, now spreading and in quantity.

II—Rare Plants thought to be Extinct

Barclaya motleyi Hk. f. in Trans. Linn. Soc. 23 (1862) 157, T. 21.

In stream, road between No. 1 and No. 2 rifle ranges, Nee Soon, Seletar Forest, *Sinclair S.F.N. 40337*, 17th July, 1954.

Recorded in Ridley's Flora from Bukit Timah, *date 1892*. It has not been seen in Bukit Timah for many years. There is another record, *Ridley*, *date 1894* from Ang Mo Kio.

Brownlowia lanceolata Benth. in Journ. Linn. Soc. 5, Suppl. 2 (1861) 57.

This was mentioned in Gard. Bull. Sing. 14 (1953) 38 as being rare in Singapore and that it was probably extinct at Kranji (*Ridley 6294*). I am glad to say now that I have found it in quantity in Kranji Nature Reserve in 1954. It does not often flower and is easily overlooked. There is yet another record from Sungei Seletar, about ¼ mile east of Nee Soon, *Sinclair 39692*, 27th June, 1953.

Ardisia villosa Roxb. in Carey & Wall., Roxb. Fl. Ind. 2 (1824) 274; Ridley, F.M.P. 2 (1923) 251.

Synonym: A. vestita Wall. in Carey & Wall., Roxb. Fl. Ind. 2 (1824) 274 in obs. (1923) 251.

Seletar Forest beyond No. 2 rifle range, *Sinclair S.F.N. 40273*, 1st May, 1954.

Although common in parts of Malaya, there is a single sheet in Herb. Singapore, *Ridley 2809* from Pulau Ubin and no specimen from Singapore Island. Ridley mentions the Pulau Ubin specimen in his flora.

Alstonia spathulata Bl. Bijdr. 2 (1826) 1037.

Marshy ground by fish ponds, off 9¾ miles Changi Road (north side), *Sinclair 40541*, 10th March, 1955. Recorded in Ridley's Flora from Tanglin but there is no specimen in Herb. Singapore. Tanglin area has long since been well drained and it is extremely unlikely to occur there now. Three trees were seen at Changi Road. These are very old and have long ago been cut down to near the base of the trunk which is obscured by many coppice-shoots. What remain now are dense bushes up to 4 m. high, so the efforts of those trying to exterminate this last record from Singapore have not been entirely successful.

Artocarpus anisophylla Miq. Fl. Ind. Bat. Suppl. (1861) 422.

More localities in Singapore for this tree have been noted since Part I of this paper was written Gard. Bull. Singapore 14 (1953) 38 and it seems now to be not uncommon. It can still be found in the Gardens' Jungle. Other records are Bukit Timah Forest Reserve at the Fern Valley and in the MacRitchie Reservoir off Lornie Road.

Halophila spinulosa (R. Br.) Aschers. in Neumayer, Anleit. Wiss. Beob. (1875) 368.

Creeping in sandy, muddy substratum near low water, Tanah Merah Besar, *Sinclair S.F.N. 40535*, 6th March, 1955. Rare.

The only previous record is from near Pulau Tekong, *Henderson* and *Corner s.n.*, 16th June, 1929. In 1–8 metres below tide level on muddy bottom. **Fig. 1E** and **F.**

Rhynchospora glauca Vahl var. **chinensis** (Boeck.) C.B.Cl. in Hk. f., F.B.I. 6 (1893) 672.

Telok Bahru, *Sinclair S.F.N. 40523*, 17th February, 1955. Very rare. There are no recent collections in Herb. Singapore. It was collected by Ridley near the above locality in 1890 (*Ridley 1722*). Other localities in Singapore with dates are Balestier Plain, *Ridley 9144*, date 1898; Changi Beach, *Ridley*, date 1892. Blakan Mati, *Ridley 5791*, date 1892. It has been found in Perlis, Kedah, Trengganu, Pahang and Johore.

Cyathea glabra (Bl.) Copel. in Phil. Journ. Sci. 4C (1909) 35.

In swamp forest beyond target end of No. 1 rifle range, Nee Soon, Seletar Forest, *Sinclair S.F.N. 40370*, 19th September, 1954, rare.

It has not been collected in Singapore since 1907. The previous records are from Stagmount, Bukit Mandai and Bukit Timah.

A Note on Embelia ridleyi King and Gamble

By James Sinclair

By chance, when examining some *Embelia* species in the Singapore Herbarium, I was surprised to see that *Embelia ridleyi* King and Gamble was not an *Embelia* at all but a species of *Horsfieldia*, namely *Horsfieldia canarioides* (King) Warb., synonym *H. racemosa* (King) Warb.

Embelia ridleyi King and Gamble was published in "Materials, Flora Malayan Peninsula" volume 4 no. 17 (1905) 112. It is also mentioned in Ridley's "Flora of the Malay Penisula" volume 2 (1923) 234. The type, *Ridley 6324*, is from Bukit Mandai, Sinpore. There is one more sheet from Chua Chu Kang, Singapore, *Ridley*, date 7th May, 1895. Both are deposited in the Singapore Herbarium. King and Gamble state, "Climbing shrub ? Calyx lobes 4–5, ovate, gland-dotted, very small. Corolla and rest not seen." Ridley says that it is a large climber at the edges of woods, very rare and not seen again, probably extinct.

In *Horsfieldia canarioides* the perianth lobes are split nearly to the base and open wider than in most other species of *Horsfieldia*. The usual number is three but there are often four and sometimes five. There is only one whorl of lobes and no separate corolla. The leaves superficially recall those of *Embelia coriacea*. Perhaps for these reasons King, Gamble and Ridley were misled. There are, however, no climbing species in the genus *Horsfieldia*. At Mandai Road, the bases of the tree trunks in the forest, being at a lower level than the road, are often obscured with undergrowth and it might be quite easy to mistake a tree for a climber in this way. *H. canarioides* also found at Bukit Timah has not been collected in Singapore for many years and is now probably extinct. It occurs, however, in Johore, Malacca, Selangor, Perak, Penang and Kedah.

PALMAE MALESICAE—XIX

The Genus Calamus in the Malayan Peninsula

By C. X. FURTADO
Botanic Gardens, Singapore

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1. Introduction

THIS PAPER is an outcome of a study of the Peninsular material of Calamus in the Singapore herbarium. With the aid of specimens having all their components numbered carefully in the field by Mr. E. J. H. Corner and myself, it was possible to detect a good many mixtures in the herbarium and to clarify the systematic status of some species hitherto obscure or confused. Some large solitary stemmed species are not yet well represented in the herbarium, either because they are confused with others in the field, or because the paucity of flowers or fruits on each plant deters one from spending much time and labour needed in felling forest trees to get specimens from such large rattans. Collections from such species are best made at a time when the forestry department is removing useful timber from felling areas. On the other hand collectors do not seem to recognise readily the specific distinctions existing in smaller rattans that are common on mountains, so that the insufficient material in herbaria suggests that the collectors have been afraid of making unnecessary duplicates; sometimes material from different plants of these species is also found mixed, a little from each, obviously with the intention of showing the male and the female flowers, fruit or other relevant parts of what collectors considered as representing the same species. Carefully numbered specimens of these rattans are, therefore, still required to clarify their status and affinities, and to show the range of variation within each species.

To be useful for critical studies, a rattan specimen should have the following parts; leaf-sheaths to show the armature and the presence or absence of a flagellum (see below) and of the knee-like swelling (*geniculum*) at the base of the petiole; a portion to show the size of the petiole and its armature; portions of leaf-lamina to show the variation and the arrangement in leaflets and the way the leaf terminates; the peduncle to show its size and armature; parts of the spadix to show the variation and armature in its different parts and also to show the way it ends; and portions of the juvenile or the radical leaf to show its deviations from the normal adult leaf. Since large specimens cannot be mounted in the herbarium, they should be cut into convenient sized portions, but every bit from the same plant (or clump) should have a tag bearing a common number of the collection, letters being added to the number to indicate any deviation from the normal adult form. Field notes should include all information needed for the correct

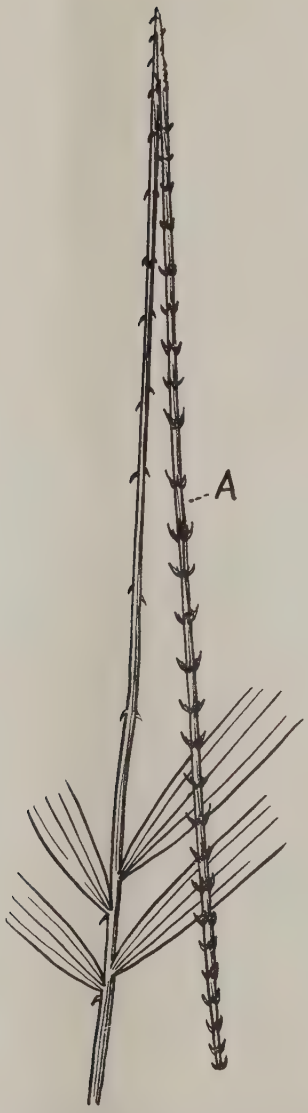
sorting and labelling of the different parts of the specimen. It would be however of great benefit to include in the notes particulars concerning the size, habit, habitat, and any other peculiarity that characterises the plant in the field but which cannot be observed in small bits of herbarium specimens. It is important never to mix specimens taken from two distinct individuals (or clumps) even when these two individuals (or clumps) appear to be specifically identical in the field. Without proper clues it is not easy for systematics to sort such mixtures in the herbarium, and so many taxonomic confusions have been the result.

Foresters will also prefer to have three or four samples of canes, each about 40–50 cm. long bearing the number of the collection; these will help to coordinate the economic data of the canes under their botanical names.

2. Morphology of Calamus Species

Calamus species are palms belonging to a class commonly known as rattans (malacca canes), which are members of a still larger group characterised in having their fruits scaly on the outside and known botanically as *Lepidocaryeae*. A great majority of the species of Calamus are climbing, some are known to attain the length of 500 feet; but erect or stemless species are also known, though only a few in the genus. The individual stems may be solitary or in clumps.

Like other rattans, Calamus species bear *spines* in many of their vegetative and reproductive parts, and the nature of these spines varies according to their location or function. Possibly the spines act as a protection for Calami against grazing or being trampled or damaged in other ways by animals, or are vestiges to show that these plants needed such protection during the course of their evolution. However, some spines are specially adapted to enable the plants to climb by fixing the spines on the neighbouring trees. These last mentioned spines have a thickened base and a sharp, curved tip, reminding one of a cat's claws; hence the term "claws" (*ungues*) has been generally employed to describe these spines, though this term bears a different meaning when applied in describing non-palmaceous plants. The parts with which these claws are most associated are the lower surface of the leaf-rachis, and the whip-like structures that give many climbing species support on distant trees and branches; the claws are often joined laterally so as to make them 3–5 digitate in the leaf-rachis, and whorled or nearly so in the whips.



Terminal portion of a leaf to show a cirrus (A)

These whips may be classified in two categories according to their origin, though both have the same function, namely, as climbing aids. In one category the whip represents a continuation of the leaf-rachis, and is termed a *cirrus*. In the other category the whip is either a sterile spadix or the long end of a fertile spadix; this has been called by Beccari a *flagellum*.* As a rule one does not find a very long cirrus on plants which are flagelliferous; but *Calamus ornatus* as represented in Malaya (var. *horridus*) produces, when young, leaves having a long cirrus which gradually disappears when the plant has been flowering for some time, so that in the earlier stages of flowering one may find both flagelliform spadices and long-cirrused leaves on one and the same plant. However, in adult plants of many species a short, reduced cirrus may be associated with a long flagellum, while a short, flagelliform appendix may be present on spadices of plants producing a long cirrus. Neither of these whips would be found on non-scandent species. The presence or the absence, and the length of these whips form therefore a good diagnostic character for classifying the species into sections.

The *leaves* are generally pinnate, bearing ensiform, linear or elliptic *leaflets*, occasionally rhomboidal or flabelloid, but never falcate or sigmoid. The leaflets are usually narrowed to a bristly point where the principal veins meet, but in rhomboidal leaflets the longitudinal nerves end at different lengths, only the central nerve reaching the apex. One species, Australian, is known to have praemorse elliptic leaflets.

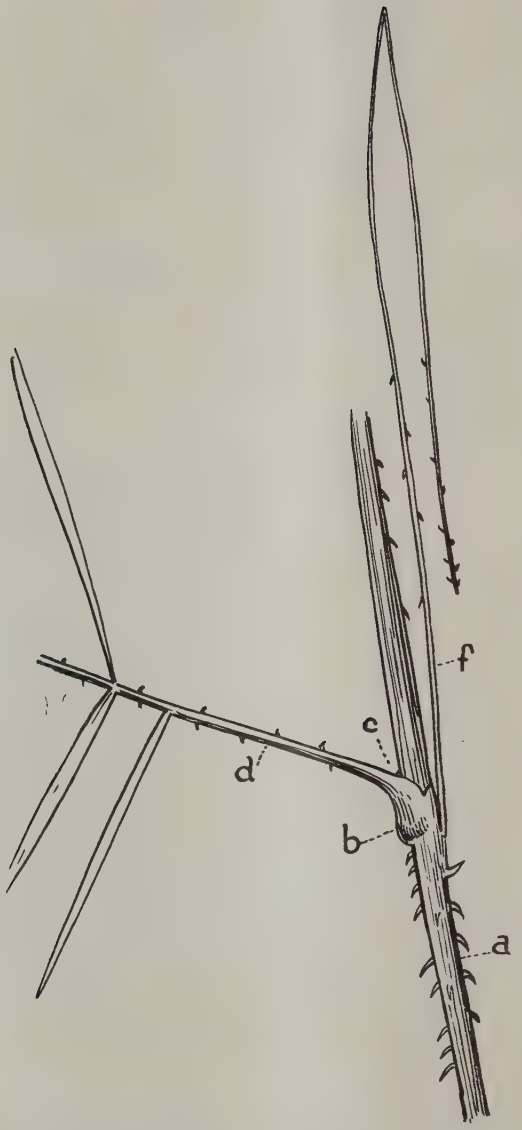
The number of main nerves (*costae*) on each leaflets is often an important diagnostic character, as also the presence or absence of setae on these nerves. Setae are also present along the margins of the leaflets, though they may fall early during the leaflet's development. The leaflets may be arranged in groups, or may be equidistant or subequidistant, or there may be a mixed arrangement. The apex of leaf may terminate in a single leaflet or a pair of leaflets, or, as already stated above, in a short or long whip-like rachis without any leaflets. In the climbing species, leaves growing from the base or the rhizome (*radical leaves*) are generally different from those on the climbing stem; the former are never cirriferous. The *petiole* varies a good deal in length according to the species, being almost absent in some cases; but in leaves borne in the juvenile parts of the climbing stem and in the radical leaves, the petiole

* The descriptive terms adopted here are those proposed by Beccari in Ann. Roy. Bot. Gard. Calc. XI (1908) Part 1. The species of Calamus. This work should be consulted for a more detailed account of the morphology of Calamus.

is often very much longer than on the leaves borne in adult parts. In climbing species, a swelling (*geniculum*) is present just below the petiole of the leaf; it appears to be due to a contraction or shortening of the tissues at the base of the petiole, and apparently serves to hook the claws of the leaf-rachis on to the bark of supporting plants and thereby obtain a firm support. This gibbosity does not occur in the leaves produced at non-climbing stages.

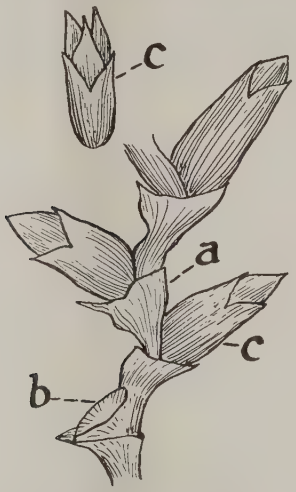
The leaf-sheath (*vagina*) is enlarged below the base of the petiole to form a complete tube covering the entire internode and also a portion of the next internode above; only in the leaves of non-climbing species or produced at a non-climbing stage the leaf-sheaths are more or less open ventrally. At the mouth of the leaf-sheath tube, at the point where the sheath passes into the petiole, there is the ligule (*ocrea*) which is tubular, membranous or chartaceous in young stages, but lacerate, usually shrivelling and becoming deciduous later. In some species from New Guinea and in all the African ones, the ocrea is extraordinary large, more or less persistent, and has many other peculiarities. In the Indo-Malayan species the ocrea is generally reduced and deciduous. The armature on the leaf-sheath and of its rim, and the length of ocrea, afford clues of very great value to distinguish between the species. Where the leaf-sheath is open, ocrea may occur on the margins.

The mode in which *spadices* arise in Calamus is very peculiar and is not found in palms outside rattans. Normally the spadix is axillary in palms, though in some cases the axillary spadix-bud does not develop until long after the fall of the axillant leaf. In many monocarpic palms where the stem terminates its vegetative growth by producing an apical spadix, one notices that the actual apical bud has aborted and the branches of the so-called terminal spadix arise each in the axil of a reduced bract. In palms which have coriaceous and tubular leaf-sheaths and which do not belong to the rattan group, the spadix may be borne in one of the two ways; it may emerge by puncturing the base of the sheath still attached to the stem or it may develop between the leaf-sheath and the stem until the leaf-sheath falls off to enable the spadix to attain its full growth. Neither of these procedures occurs in the genus Calamus, where the spadix is inserted outside on the leaf-sheath just by the side of, or opposite to, the petiole, though often at a level slightly lower than that of the petiole's insertion on the same sheath. However from the ridge of fibro-vascular bundles that passes down the sheath into the internode below, the conclusion seems that at an early stage of evolution, when the genus was still plastic, the protective tight covering of the leaf-sheath did not



a, sheath; b, geniculum; c, ocrea; d, petiole; f, flagellum.

allow the primordial axillary spadix to differentiate itself until there were no obstacles in the way of its free development; and so the spadix, though axillary in origin, grew within the tissue only to appear externally on the leaf-sheath of the following leaf.



Male spikelet. a, spathel; b, involucre; c, male flower.

Spadices vary in length and may be classed into four categories as follows:—

(1) The spadix is very long, flagelliform, much longer than the leaves, which are non-cirriferous, or subcirriferous;

(2) The spadix is nearly as long as the leaf which may be shortly cirriferous;

(3) The spadix with its abortive flagellum (if any present) is much shorter than the leaf which is provided with a very long cirrus; and

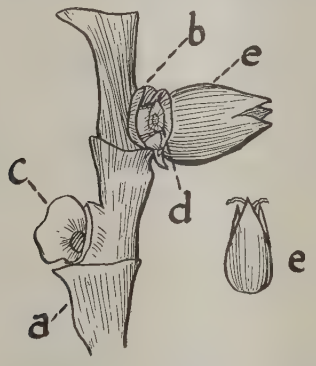
(4) The spadix is very much shorter than the leaf which is imparipinnate, paripinnate or subcirriferous (separated as a new genus Cornera).

These characters combined with those of the spikelets and involucrophores (vide infra) are of great use in grouping the species in a given section according to their affinities and in distinguishing between the species that are likely to be confused in the field.

The primary branches on a spadix are called *partial inflorescences*; and these may themselves bear flowers or be subdivided again to bear secondary branches, and so on, so that the flowers

may be borne on secondary, tertiary or quaternary branches. As a rule primary branches are long, distant and pendulous in the first category of spadices mentioned above, slender, nearer to each other and shorter in the second category, stouter and much closer in the third, and congested and short in the fourth (Cornera). Often the axis on which the branches are inserted is so developed that each branch appears to arise at the mouth of its axillant spathe, or much outside it; in a few groups of species the base of the branch is long and remains inserted within its axillant spathe and is said to be *pedicellate*. One calamoid species from New Guinea (*Schizospatha setigera*) has been separated from Calamus because the primary branches of the spadix emerge by puncturing the primary spathes—a phenomenon not seen in other calamoid species (Furtado in Gard. Bull. Singapore, XIV, 1955 p. 525).

The spadix may be either seed-bearing or male. A seed-bearing spadix produces female flowers each of which is usually accompanied by a male flower. However, this male flower, though it may develop and bear pollen, is often without pollen or falls off long before it is mature, and so, as in Daemonorops, the precise function of this flower is not yet very clear. Following the terminology of Beccari, this acolyte flower has been termed *neuter* and the seed-bearing spadix *female*. The *male spadices*, on the other hand, have only male flowers. As in Daemonorops, it is enough to examine one spadix or even a spikelet to know the sex of all the spadices that were produced or will be produced on the same individual plant and on all the individual stems if they grow in the same clump; for both kinds of spadices are not known to be produced on the same plant or in the same clump. However there are



Female spikelet. a, spathel; b, involucrophore; c, involucre; d, areola; e, female flower.

occasional abnormalities; thus a female spadix may be found bearing only male flowers in its apical spikelets, but this is not a characteristic of the species.

Spathes are essentially tubular and nearly as long as the included internode, or sometimes even longer. In its peduncular parts, the spadix may bear one or two spathes which are usually bicarinate, and differ from the others in armature. Spathes on the main axis of the spadix are primary, while those on the primary and secondary branches are termed respectively secondary and tertiary spathes.

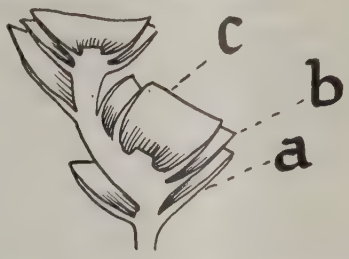
Flowers are never borne on the main axis of the spadix, but on its ultimate branches (*spikelets*) which, as said above, may be primary, secondary, tertiary or quaternary branches. Usually only one spikelet grows in the axil of a spathe, but in rare instances (e.g. *C. polystachys*) 2–3 spikelets may arise from the axil of a spathe (as a result of the abbreviation of the axis of the branch bearing the spikelets). The lower spikelets are always larger than the upper ones, and some of lower ones may have short lateral branches.

The flowers arise each in the axil of a small spathe (*spathel*). In the *female spikelets*, the spathels are tubular or somewhat funnel-shaped; only in rare cases the spathel is reduced to an annular, bracteole-like structure. The stalk of a female flower is somewhat complex. Its lowermost part (*involucrophore*) is short and has a cup-shaped apex. Moulded into this apex is another cup-shaped pedicel called an *involucre*. The involucrophore is inserted at the mouth of its axillant spathel or above it, or even at the base of it, and may be sessile or conspicuously stalked. The involucre bears a female flower, but on the outer side of the flower there is another niche-like dent (*areola*) which bears the neuter flower. In some species, two female flowers each with its separate involucre and acolyte neuter flower are found on one involucrophore. The facts that the involucrophore bears sometimes two flowers, each with its own separate involucre, and that it reproduces many characteristics inherent in the higher subdivisions of the spadix show that the involucrophore is an abbreviate spikelet axis.

The *male spikelet* is shorter but bears flowers more densely. The spathels, which are bifariously disposed, are much expanded on the side of the flower, so that they look like boat-shaped bracts. Inside the spathel is the involucre on which is inserted the male flower. Occasionally in some species male flowers may be found

in groups of two or more, each with its own reduced spathel, the entire group being inserted in the axil of a primary spathel.

The *female flower* is usually short and stout, having a cupular or subcampanulate calyx, more or less deeply three toothed. The corolla which has segments usually more deeply divided and narrower than those of the calyx, is, as a rule, nearly as long as, or slightly longer than, the calyx; but in a few cases the corolla is much longer. The ovary is globular, oblong, ovate or obovate, and is covered like the ovaries of the other *Lepidocaryeae* with imbricate scales. The style is divided into three short stigmata, each corresponding to a loculus below; but out of these three loculi, only one generally develops to make the fruit one-seeded.



Female spikelet (vertical section). a, spathel; b, involucrophore; c, involucre.

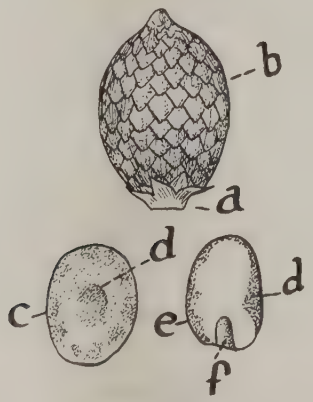
The *perianth* formed of calyx and corolla persists till the fruit is fully developed. After the fertilisation of the ovary, the perianth will sometimes become thick and hard and acquire a special shape so as to offer a good diagnostic character, two main classes being based on whether the perianth on the fruit is deeply divided and flattened, or pedicelliform.

The *fruit* is covered with *scales* arranged in definite longitudinal series (*orthostichies*). This number of scale-series offers a good diagnostic character, since the numerical variation in scales in a given species or variety is very limited. The range of variation in the series for the whole genus is 12–27, and the species having less than 18 vertical series vary less than those with more. Underneath the scales and surrounding the seed is a fleshy edible integument which being pleasant to taste makes the large fruits marketable. The *seed* is usually bifacial being depressed on one side (*chalazal* side), and differs in shape and size and in rumination according to the species. In some species the ruminations are very superficial and then the fruit is described as having a homogeneous albumen; in other cases the ruminations are very deep;

but there are also gradations between these two extremes. The *embryo* is basal or lateral, or near to the centre of the undepressed side of the seed.

The *male flower* is longer and more slender than the female, the longest being about 1 cm. The calyx is tubular and slightly 3-lobed; the corolla is much longer than the calyx and divided nearly to the base. The stamens are 6 in number arranged in one or two rows round an abortive ovary.

The neuter flower is very like the male, but smaller, and usually provided with undeveloped anthers; but developed anthers may be occasionally found. Hence the term "neuter" may not be appropriate to characterize these flowers, but so far it has helped to avoid many confusions in specific descriptions. The flower is inserted in a special niche (*areola*) on the outer side of the involucre bearing the female flower.



Fruit. a, perianth; b, fruit; c, seed showing the depression (fovea) (d); e, seed vertically cut to show the fovea (d) and embryo (f).

Three Malayan species (one of which is new) have been removed from Calamus to Cornera. This genus is characterized by ecirriferous or subcirriferous, leaves short, non-flagelliform spadices, primary spathes which are tubular at base but somewhat dilated upward ending in an auriculiform apex; short primary spadix branches, each having the appearance of being the elongation of the main axis, while the continuation of the main axis looks like a branch; short spikelets; congested, large, secund or subsecund flowers, and large fruits with unchannelled scales.

3. Calamus differentiated from Daemonorops

The morphological characters in the preceding section may be summarized thus:

Dioecious, or sometimes androgynous, polycarpic plants, with slender, long or dwarf, climbing, erect or almost acaulescent stems; often provided with long whips, each representing a prolongation of a fertile or sterile spadix (*flagellum*) or of a leaf-rachis (*cirrus*); variously armed in different parts of spadices usually elongated and as long as, or longer than the pinniferous portion of the leaf, but sometimes considerably shorter; spathes persistent, tubular but sometimes expanded in the broad, entire or lacerate lamina in the terminal part; flowers unisexual, with bifarious or quadrifarious arrangement on the spikelets; the female spadices having male or neuter flower accompanying the female flower; the involucrophore and involucre of the female flower usually cup or saucer-shaped at apex; female calyx more or less deeply 3-lobed, nearly as long as, or shorter than, the corolla; fruit covered with scales; albumen homogeneous, or slightly or deeply ruminate; embryo basal or lateral.

The genus Daemonorops is very like Calamus, but never has the following characters; flagelliferous leaf-sheaths; *persistent spathes tubular at the base;* strong claws on the spathes and spadix-axis; funnel-shaped tubular female spathels; *involucrophore with a cup —or saucer-shaped apex; a deeply lobed female calyx*, the latter nearly as long as the corolla, homogeneous albumen and lateral embryo. All these characters are found in Calamus, though not all in the same species, only the characters marked in italics being common to all the Malayan Calami. By means of these characters, even imperfect specimens of Calamus (or of Cornera and Schizospatha) may be distinguished from those of Daemonorops.

4. Distribution

The centre of development of the genus Daemonorops is Malaya, Sumatra, and Borneo, and to a diminished extent in the Philippines, Celebes and Java, though a few species may be found in the neighbouring regions: Eastern Bengal and Assam, Andamans, Burma, Siam, Cochin-China, Lower China and the Aru Islands. The centre of the development of the genus Calamus is, however, much wider, extending from Malaya, Sumatra, Borneo, Java, Philippines, Celebes to New Guinea in the East, and Cochin-China, Siam, Burma and Bengal in the North, and Ceylon, and Malabar in the West. Some Calami also occur in Australia, Southern parts of China and Japan, in the Himalayas, and in West Africa.

5. Sections

There have been some attempts in the past to divide the genus into sections on the persistency of the primary spathes, and on the nature of their upper half (Griffith, 1844), and on the origin and the presence of the whip-like structures (Ridley, 1907), or on a compromise of these two systems (Martius, 1850). Beccari, to whom much credit is due for clearing up the confusion that existed in the generic and specific identity of many rattans, subdivided Calamus in sixteen groups, but did not name them botanically; these were based on the characters of spathes and the stalks of spikelets, the shape of leaflets, and the presence or absence of the whip-like structures at the end of the leaves or on the leaf-sheaths. These characters, plus the comparative length of the spadix in relation to the leaves, have been found to afford a good means of grouping the species according to their affinities. Hence the genus has been divided here into seven sections. One section *Afrocalamus* is restricted entirely to Africa. There is an evidence that many of the New Guinea species would form a section or a subsection by themselves, but the material at my disposal is not sufficient for a conclusive decision.

6. Summary

In Ridley's Flora Malay Pen. V (1925) which is the latest extensive treatment of the Malayan species of Calamus, only 46 species have been treated under the genus, including the one (*C. Griffithianus*) which has been reduced to a variety of *C. castaneus*. In the present treatment there are 72 not including the three Malayan species (two old and one new) that have been transferred to Cornera (Furtado in Gard. Bull. Sing. XIV, 1955 pp. 518–525). Ridley's *Plectocomiopsis ferox* which was excluded from that genus being a species of Calamus (Furtado in Gard. Bull. Sing. XIII, 1951 p. 338 t. 14) has been recognised as *C. concinnus*; there is some doubt as to the leaf-sheath, but the possibility that the species produces such leaf-sheaths in older stage is not excluded. The results may be summarised as follows:—

(*a*) NEW SPECIES (recorded by their specific epithets only; **balingensis, belumutensis, benomensis, chibehensis, Corneri, distichoideus, flabelloideus, Hendersonii, Holttumii, kemamanensis, Koribanus, mawaiensis, Moohousei, oreophilus, padangensis, pandanosmus, peregrinus, riparius, speciosissimus, spectatissimus, Tanakadatei, tumidus;** and two non-Malayan: **penibukanensis** and **Slootenii.**

(*b*) NEW VARIETIES: C. castaneus var. **Griffithianus** (*C. Griffithianus*), C. ciliaris var. **peninsularis,** C. Diepenhorstii var. **kemamanensis,** C. javensis var. **laevis,** C. Oxleyanus var. **montanus,** C. perakensis var. **gracilis,** and C. siamensis var. **malaianus.**

(*c*) NEW RECORDS: C. flabellatus, C. longisetus, C. myrianthus, C. Oxleyanus var. obovatus, and C. Manan.

(*d*) SYNONYMS REVIVED: C. bubuensis and C. multirameus.

(*e*) SPECIES UNACCOUNTED: *C. pacificus* Ridl. (= C. Diepenhorstii?).

(*f*) SPECIES TYPIFIED: C. longispathus and C. elegans.

In order to clarify the affinities of the species and facilitate identification, the genus has been divided into seven Sections and four Subsections. It was found that five new sectional and two new subsectional names had to be coined, the rest being given old names created by Griffith (1845). These sections do not include the Calami separated to form the new genera, Cornera and Schizospatha (Furtado in Gard. Bull. Singap. XIV, 1955 pp. 517–529).

NEW SECTIONS: 1. **Podocephalus,** 2. **Macropodus,** 3. **Afrocalamus,** 4. **Phombocalamus,** 5. **Phyllanthectus** subsect. **Phyllanthectus,** 6. **Phyllanthectus** subsect. **Cirruliferus,** 7. **Platyspathus,** 8. **Coleospathus** subsect. **Caryotoideus,** 9. **Coleospathus** subsect. **Coleospathus.**

Of these, the Section 3 is exclusively of African species, and the Subsection 8 is wholly Australian (monotypic).

7. CLAVIS SECTIONUM

1a. Spiculae valde pedicellatae, infra apicem vel prope basin spatharum orientes. (Species scandentes cirriferae vel ecirriferae; unica species, *C. Flagellum*, flagellifera)

1. **PODOCEPHALUS** Furtado.

(Beccari's Groups I, IIB, & XIV).

1b. Spiculae haud pedicellatae, prope spatharum apicem orientes .....(2)

2a. Involucrophora pedicellata .....(3)

2b. Involucrophora sessilia vel fere .....(4)

3a. Involucrophorum pedicellatum exsertum, prope spathellae apicem oriens. Perianthium fructiferum pedicelliforme. Ocrea in latere axiali elongata. (Species omnes Asiaticae non-Africanae)

2. **MACROPODUS** Furtado.

(Beccari's Groups VII, VIII, & XII).

3b. Involucrophorum pedicellatum, haud exsertum, prope spathellae basin oriens. Perianthium fructiferum explanatum. Ocrea in latero abaxiali liguliformiter producta (Species omnes Africanae)

3. **AFROCALAMUS** Furtado.

(Beccari's Group III)
(Typus: *C. deeratus* Mann & Wendl).

4a. Foliola linearia vel elliptica, haud rhomboidea, cum costis primariis vel subprimariis omnibus eorum apicem attingentibus, vel in unica specie apice praemorsa .....(5)

4b. Foliola utrinque attenuata, rhomboidea, costa primaria mediana tantum ad apicem attingente, alteris costis altitudine diversa evanescentibus. (Species flagelliferae, cirro brevi vel abortivo praeditae).

4. **RHOMBOCALAMUS** Furtado.

(Beccari's Group XI).

5a. Species scandentes flgagelliferae; non-scandentes non-flagelliferae. Spadices frondibus multo longiores. Frondes apice subcirriferae vel ecirriferae .....(6)

5b. Species non-flagelliferae. Spadices frondibus plerumque minores. Frondes ex speciebus scandentibus conspicue cirriferae, ex speciebus erectis vel semi-scandentibus ecirriferae, subcirriferae aut imparipinnatae.

5. **PHYLLANTHECTUS** Furtado....(A).

(Beccari's Group XV).

Aa. Frondes sine cirro quam spadices multo longiores. Spadices crassi, robusti, unguibus valdis armati, breviter pedunculati. Caudices plerumque crassi, scandentes

Phyllanthectus subsectio **Phyllanthectus.**

Ab. Frondes ecirriferae vel subcirriferae vel breviter cirriferae, sine cirro spadiciebus fere aequilongae. Spadices graciles unguibus debilibus armati vel inermes, erectiusculi vel funiformes, pro rata longe pedunculati. Caudices plerumque graciles vel acaulescentes

Phyllanthectus subsectio **Cirruliferus** Furtado.

6a. Spathae primariae basi tantum stricte tubulares, apicem versus laminares vel loriformes vel fissae, interdum laceratae. (Frondes ecirriferae)

6. **PLATYSPATHUS** Griff.

(Beccari's Groups IIA & VI).

6b. Spathae primariae per totam longitudinem stricte tubulares

7. **COLEOSPATHUS** Griff. . . . (B).

Ba. Foliola praemorsa (dua apicalia basi connata)

subsectio **Caryotoideus** Furtado.

(Beccari's Group V Species No. 43)

(Species unica: *C. caryotoides* All. Cunn).

Bb. Foliola haud praemorsa, apice acuta vel acuminata. (Frondes ecirriferae vel subcirriferae.

subsectio **Coleospathus.**

(Beccari's IV, V, IX, & XIII)

I. Sectio PODOCEPHALUS Furtado **sect. nov.**

Vaginae frondium non-flagelliferae. *Frondes* cirriferae vel ecirriferae. *Spadices* haud flagelliformes, frondibus minores. *Spathae* tubulares. *Spiculae* pedicellatae, pedicellis prope spatharum basin axillanthium orientibus. *Involucrophora* sessilia vel subpedicelliformia, haud exserta. *Perianthium fructiferum* explanatum. *Albumen* seminis ruminatum vel aequabile.

DISTRIBUTIO: Species hujus sectionis paucae, in Ceylona, Nicobaria, Andamania, Malaya, Java, Celebesia et Nova Guinea incolunt.
SPECIES TYPICA: *C. aquatilis.*

The species of this section are distinguished by having pedicellate spikelets. Beccari's Groups I, IIB & XIV are therefore included here. The leaves may be ecirriferous, or cirriferous, and the involucrophores are short, sessile or subpedicelliform, not exsert nor conspicuously pedicelliform.

In this section some species belonging to Beccari's Groups I & IIB, have large flowers and fruits as in the genus Cornera, but the spikelets are not congested, the flowers are bifarious and the fruit scales are channelled in the middle.

Key to the Malayan Species

(a) Leaves not cirriferous. Stems small, erect or trailing, never climbing. Leaf-sheaths armed with brownish, solitary, flat, triangular spines.

C. castaneus Griff. and its var.
Griffithianus (Mart.) Furtado.

(aa) Leaves strongly cirriferous. Stems, long, climbing. Leaf-sheaths armed with blackish, often criniform spines.

(b) Spines on the leaf-sheaths criniform and laminar mixed, reflexed, often confluent at the base into horizontal rows, or generally incomplete rings. The geniculum not densely armed except at the very base. Spikelets one at each spathe.

C. aquatilis Ridl.

(bb) Spines on the leaf-sheaths criniform, thickly set, generally seated on broad membranous reversed (decussate) complete rings. Geniculum thickly covered with spines. Spikelets 2-3 at each spathe, sometimes only one in the upper parts of inflorescence branches.

C. polystachys Becc.

ENUMERATION OF THE SPECIES

1. Calamus castaneus Griff. In Calc. Journ. Nat. Hist. V (1845) 20 var. B., and Palms Brit. Ind. (1850) 37 var. B. tt. CLXXXV A, B. & C; Mart., Hist. Nat. Palm III (1850) 331 and I (1849) Z.VIII f. XXII, Z.XXI F.II, & Z.XXII f. XV; Becc. in Hook. f., Fl. Brit. Ind. VI (1892) 440; Ridl., Mat. Fl. Mal. Pen. II (1907) 211 partly; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 145 t. 16; Ridl., Fl. Mal. Pen. V (1925) 63 partly.

(a) var. **castaneus**

Stem acaulescent or about 1·5 m. long, 4–6 cm. in diam., tufted (suckers trailing when young ?). *Leaves* very long, non-cirriferous, with a petiole about 1–2 m. long and a lamina about 1·5 to 2·5 m. long. *Leaf-sheaths* armed with many unequal, light brown, mostly ascending, solitary (sometimes confluent at base) spines, the largest up to 6 cm. long, 5 mm. broad at base. *Leaflets* numerous, ensiform, the largest about 70 cm. long, 4–5 cm. wide, paler beneath, with bristles on 3 nerves on the lower surface. *Spadices* rather short, 30–45 cm. long, produced just near the base; male spadices being longer and more branched; spikelets pedicellate. *Fruiting* perianth deeply split, not pedicellate. *Fruit* large, 20–24 mm. long, oblong, distinctly beaked, with uniform chestnut-brown scales arranged in 24–27 longitudinal series; albumen equable.

LOWER SIAM: Singgora, Kampong Bukit (Kiah 24,258).

MALAYA: Penang, Western Hill (Haniff 9,110). **Pahang,** Sungai Yu (Nur 11,924 as *Rotan Chuchur*); Bukit Senai (Henderson 19,427, as *Rotan Chuchoh*). **Malacca,** Gadek (Burkill 2,163).

This type form was described by Griffith as var. *B.* of the species. The syntypes were from Malacca. Beccari described the undersurface of the leaflets of this species as having bristles only on the midnerve, but in all the specimens examined by me the three nerves are bristly. The only way I have been able to separate these specimens from the var. *Griffithianus* is by the number of the longitudinal rows of the scales on the fruit, the specimens with fruit-scales in more than 24 series being cited here. I have not been able to separate the male specimens, and so they are all cited under the var. *Griffithianus*.

(b) Calamus castaneus Griff. var. **Griffithianus** (Mart.) Furtado **stat. nov.—t. 1.**

C. Griffithianus Mart., Hist. Nat. Palm. III (1850) 332 & I (1849) t. Z. XVII f. XXVII & Z. XXI f. XIV; Becc. in Hook., f., Fl. Brit. Ind. Vi (1892) 440; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 147 t. 17; Ridl., Fl. Mal. Pen. V (1925) 64— **basinym.**

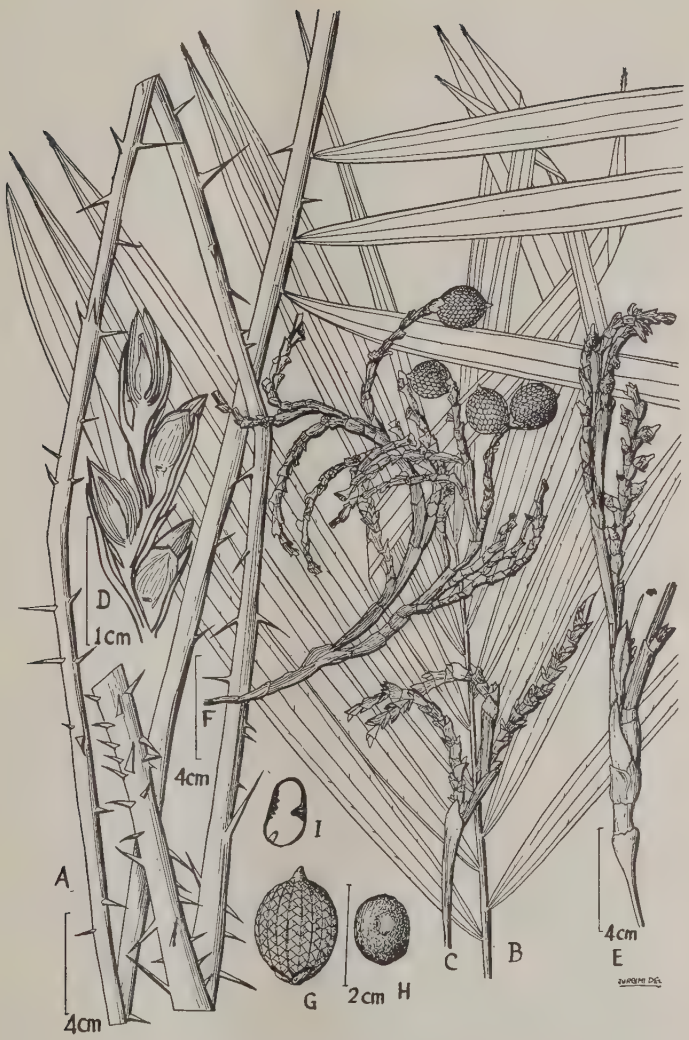
C. castaneus Griff. var. in Calc. Journ. Nat. Hist. IV (1845) 29 and Palms Brit. Ind. (1850) 38; Ridl., Mat. Fl. Mal. Pen. II (1907) 211 partly.

A forma typica differt squamis fructus per series 18–24 verticales dispositis.

MALAYA: Kedah, Baling at Ayer Turjang Valley (Furtado 33,051 & 33,052). **Kelantan,** Sungai Lebir, end of Bukit Batu Papan (Henderson 29,636 & 29,583). **Pahang,** Tahan (Ridley "A"); Gunong Senyum (Henderson 22,221); Sungai Tekal Besar in Temerloh (Henderson F.M.S. Mus. No. 10,732); Kuala Lipis (Machado in 1898). **Perak,** Temango (Ridley 14,707); Lumut (Ridley 7,903 & 9,467; Curtis 3,454); Tapah (Ridley 14,114); Bujong Malacca (Ridley 9,810); Kroh in Pahang Chong Forest Reserve (Furtado 33,011[a] & 33,010[b] vern. nom. *Rotan Udang*); Temengor (Schebesta 9, et s.n. vern. nom. *Chucho* in Malay and *Kuku* in Sakai). **Selangor,** Semenyih (Hume 8,199); Bukit Kudah (Ridley 3,478); Kuala Lumpur (Ridley's collector 3,477; Ridley on 27–VI–1889); Langat (Ridley on 1–VII–1889); Kwang (Ridley 13,450). **Negri Sembilan,** Tampin (Nur 1,307). **Johore,** Serom (Ridley in 1900). **Malacca,** Selandan (Holmberg 842); loc. incert. (Alvins 583, vern nom. *Kayu Magajar,* & 287, vern nom. *Pokok Chuchoo*); Ayer Panas (Goodenough 1,397; Hervey in 1890); Nyalas (Goodenough 1,721).

This plant is just like the type, but is distinguishable from it only by its fruits which have the scales arranged in 18–24 vertical series. The fruiting specimens included here bear the scales in 18, 19–20, 20, 20–22, 21–23, 22, 22–23, or 24 series.

Judging from the specimens cited here, this variety seems to be more common in Malaya than the type form, but Ridley (op. cit. 1907 & 1925) notes that the type form is the commoner of the two. Ridley also notes that this variety is a larger plant of the two, but according to Beccari (1908) this is smaller of the two.



Tab. 1. *Calamus castaneus* var. *Griffithianus (Furtado 33,051).*

A, Frondis pars cum petiolo. B, Ejusdem pars apicalis. C, Spadicis fragmentum cum floribus. D, Spicula verticaliter discissa. E, Spadicis ramus cum fructibus juvenilibus. F, Ejusdem ramus cum fructibus maturis. G, Fructus. H, Semen. I, Idem verticaliter discissum ut ruminatio superficialis et dispositio embryonis appareant.

Beccari notes that the leaflets in this variety are "distinctly disposed in large groups and probably in *C. castaneus* [the type form] are equidistant," observing at the same time that he had not the opportunity of seeing an entire leaf of the type form. However in all the specimens quoted under this variety and under the type form, the leaflets are equidistant, and Martius described the leaflets of this variety as equidistant. All my collections that were studied in the field have also leaves with equidistant leaflets, not in groups. However in Henderson 29,583 (Kelantan) there are leaf-bases which show a slight grouping of leaflets, but this appears to be only at the base; the leaflets higher up do not show such a grouping. It is possible that such a grouping of leaflets occurs in the young stages.

Father Schebesta reports that terminal young part of the stem (*umbot* in Malay) is eaten by Sakais and that the leaves are used for thatching. The vernacular names given by collectors as *Rotan Atap Chuchur* or *Rotan Chuchur* also suggest that the leaves are used for thatching, a use also noted by some collectors in Malacca.

Beccari notes that the stem of this variety creeps in young stages.

2. Calamus aquatilis Ridl., in Journ. Roy. Asiat. Soc. Straits Branch XLI (1903) 43, and Mat. Fl. Mal. Pen. II (1907) 210; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 393 tt. 168 and 169; Ridl., Fl. Mal. Pen. V. (1925) 63; Merr. in Univ. Calif. Publ. Bot. XV (1929) 22.—**t. 2.**

Stem scandent, 5–10 m. long, 2·5–3 cm. thick. *Leaf-sheaths* densely covered with criniform, reflexed bristles more or less confluent at base. *Leaves* large, about 2 m. long, with a long cirrus at the end; petiole 15–20 cm. long. *Leaflets* many, linear, ensiform, equidistant, 3·5–5 cm. apart, largest about 30–35 cm. long, 2·5–4 cm. broad; setose on the lower surface along the nerves and sprinkled with small rusty scales. *Male spadix* large and diffuse; partial inflorescence 40–60 cm. long; ultimate spikelets 10–15 cm. long, with 8–10 closely-disposed male flowers. *Female spadix* panicled with partial inflorescences up to about 50 cm. long, each with about 20–25 alternate, 5–10 cm. long, spikelets; each of the longer spikelets bearing about 20 flowers on each side. *Fruit* globose, about 8–10 mm. in diam.; scales in 12 series, having dark brown margins, channelled in the middle; albumen equable.

MALAYA: Pahang, Kuala Brawas (Ridley 577, syntype ?). **Selangor,** Port Swettenham (Burkill 1,511). **Johore,** Batu Pahat, swampy place by sea (Ridley 11,216, syntype, male and female under this No.). **Singapore,** Pongol Road (Fox. comm. Ridley's No. 11,304, syntype ?); Gardens' Jungle (Furtado on 10–XI–1932); Holland Road (Burkill 2,037); Changi (Ridley 6,275, syntype, vern. nom. *Rotan Bakau*); loc. incert (Ridley 11,220).

BORNEO: British North Borneo, Tawao (Elmer 20,612; Cuadra A2,435, vern. nom. *Rotan Bakau*); Sandakan at Kabili-Sepilok (Enggoh 7,433, vern. nom. *Rotan Bakau*).

Tab. 2. *Calamus aquatilis (A–D = Ridley 11,220; E = Ridley 11,216).*
A, Frondis vagina et petiolus. B, Ejusdem fragmentum. C, Spadicis fragmentum fructiferentis. D, Fructus. E, Spadicis pars masculi cum spiculis.

This rattan is common in saline swamps. The Garden specimen may have been from a cultivated species.

Ridley described this species on the assurance from Beccari in litt. that it was new, and Beccari had seen the duplicates of Ridley 11,216 & 11,304. The latter is perhaps the specimen cited by Ridley as being from the vicinity of Serangoon Road to which Pongol Road is joined.

3. Calamus polystachys Becc. in Ann. Roy. Bot. Calc. XI (1908) 383 t. 162 et in Suppl. (1914) 77; Furtado in Straits Settl. Gard. Bull. VIII (1935) 256.—**t.t. 3 & 3a.**

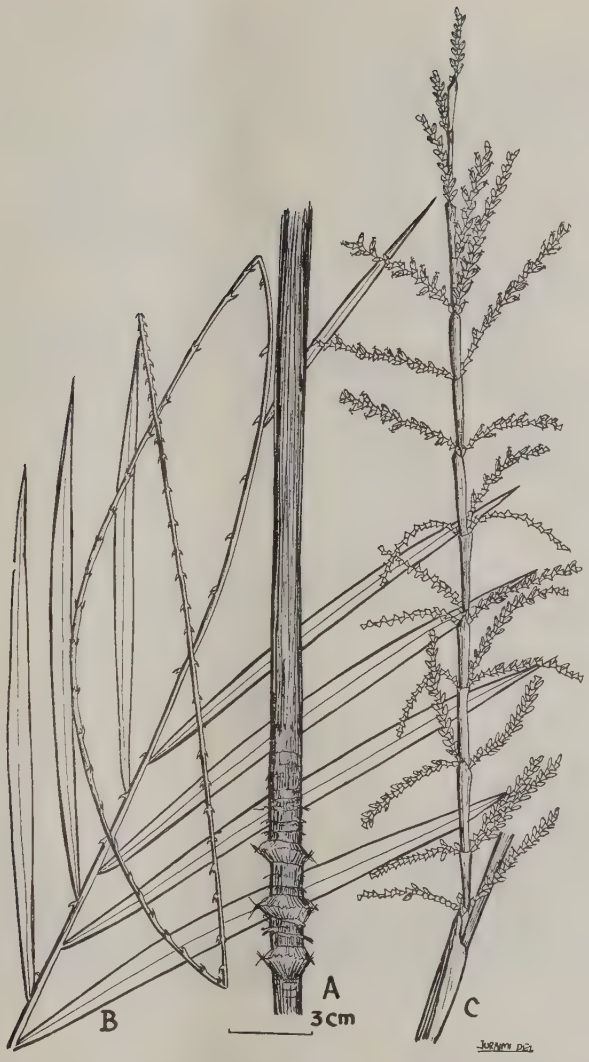
Stems tufted, 15 m. long, 3–4 cm. in diam. *Leaf-sheaths* provided at intervals with complete, membranous, reversed rings fringed with blackish, criniform bristles. *Leaves* large, about a metre long, terminating in a long cirrus, about 1·5–2 m. long, armed with strong, digitate claws. *Leaflets* numerous, equidistant, ensiform, up to 50 cm. long, 2 cm. broad, 3-costulate. *Spadix* non-flagelliform, apparently shorter than the leaves, about 1 m. long, having 3–5 partial inflorescences. *Spikelets* 2–3 at each of the lower spathes in the partial inflorescences, pedicellate, 5–8 cm. long, with 14–16 flowers on each side. *Involucrophore* cupular. *Fruiting perianth* explanate, deeply divided. *Fruit* ± 15 mm. long, 7–10 mm. in diam.; scales darkish at margins, in 12 vertical series; albumen homogeneous.

MALAYA: Pahang, Pulau Tioman at Juara Bay (Burkill 990, vern. nom. *Rotan Belukar*).

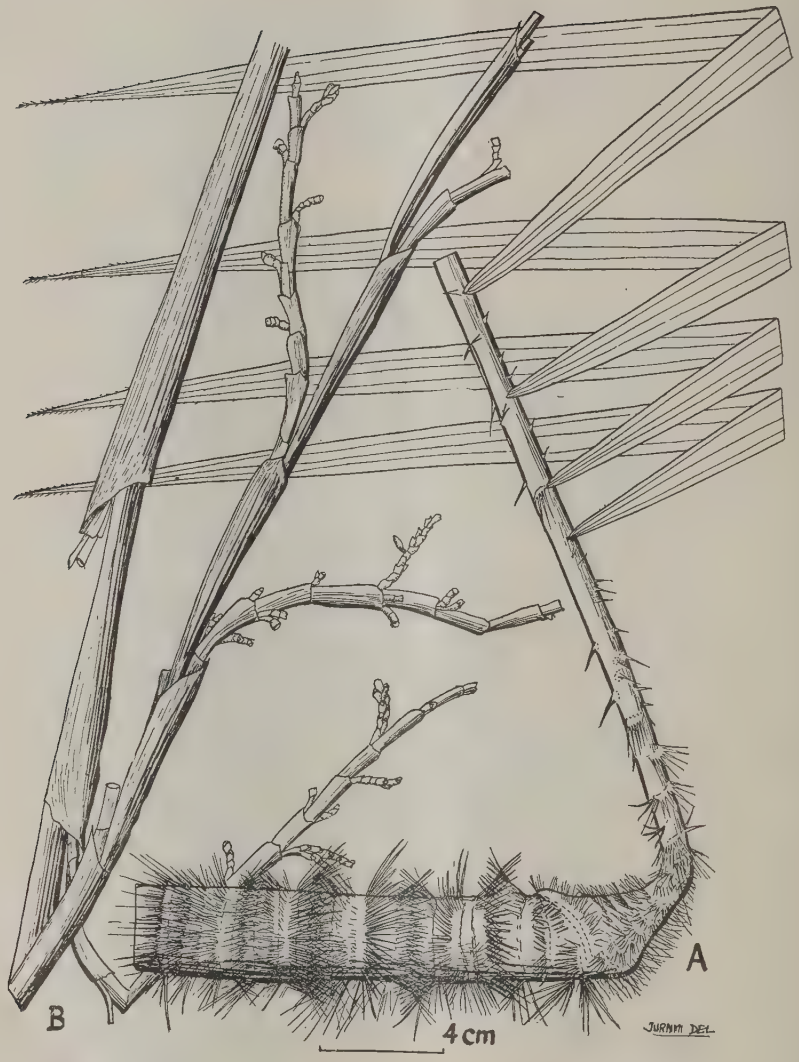
BORNEO: British North Borneo, Sandakan (Ramos 1,400 & 1,788 in Kew Herb.); loc. incert. (in Hort. Bogor, sub. Num. XII. C. 92 culta, leg. Furtado 30,815, probably clonotype).

This is the first record of the species from Malaya. Beccari (1914) believed the species to be native of Sumatra, but it has already been shown that much reliance cannot be put on the clues which led Beccari to this conclusion (Furtado, 1935 p. 256). The holotype specimen was derived from a plant cultivated in the Botanic Gardens, Buitenzorg (Bogor). In 1936, in trying to locate in the Gardens the plants from which Beccari had obtained material for his descriptions of rattans, I found only one clump from which Beccari could have obtained the type material for *C. polystachys*, namely, the clump XII. C. 92, from which specimens were distributed by me under the Singapore Field No. 30, 815. An inquiry into the origin showed that the clump was raised from seeds obtained from Borneo.

I had no access to Ramo's collections while preparing this work; but they were examined while preparing my earlier notes (Furtado 1935); and the present description of the fruit is based on those notes.



Tab. 3. *Calamus polystachys (Burkill 990 ♀).*
A, Caudicis fragmentum cum vaginis. B, Frondis fragmentum apicale. C, Spadicis fragmentum cum ramo primario.



Tab. 3a. *Calamus polystachys (Furtado 30,815—clonotypus?).*
A, Frons cum vagina, petiolo et foliolis basalibus. B, Spadicis pars feminei.

II. Sectio MACROPODUS Furtado **sect. nov.**

Vaginae frondium flagelliferae. *Frondes* ecirriferae vel subcirriferae. *Spathae* tubulares, coriaceae, rarissime apice partim laminares, marcescentes laceratae. *Spiculae* haud pedicellatae. *Involucrophorum* conspicue pedicellatum, exsertum. *Perianthum fructiferum* pedicelliforme. *Albumen* seminum variabile, aut profunde vel superficialiter ruminatum, aut homogeneum.

DISTRIBUTIO: Species hujus sectionis in India, Cochin-China, Malaya, Borneo, Java, Celebesia et Nova-Guinea incolunt.

SPECIES TYPICA: *C. peregrinus.*

This section, which includes Beccari's Groups VII, VIII, X & XII, is characterized by the involucrophores being conspicuously pedicellate and exsert, while the spikelets are sessile and the fruiting perianth pedicelliform. The leaf-sheaths are flagelliferous in climbing stems, while the leaves are ecirriferous or subcirriferous (with a short cirrus bearing irregularly-placed diminutive leaflets).

Key to the Species

(A) Leaves about 40–100 cm. long. Leaflets narrow, up to 15 mm. broad, 1–3 cm. apart, bristly on the primary and secondary costas on one or both surfaces.

(B) Leaves 40–60 cm. long, rarely longer. Hairs, or their rough bases, present on the leaf-sheath, petiole, and spadix (Leaflets 10–20 cm. long, 10 mm. broad, 10–15 mm. apart, bristly on both surfaces).

(a) Fruit oblong; scales with dark margins.

C. exilis Griff.

(aa) Fruit round or globose; scales straw coloured, concolorous, or paler in the margins.

C. ciliaris Bl. var. **peninsularis** Furtado.

(BB) Leaves 50–100 cm. long. Hairs, or rough bulbous bases, absent on the leaf-sheath, petiole and spadix. (Leaflets bristly usually on one surface).

(b) Leaflets 15 cm. long, 8 mm. broad, 10–15 mm. apart, setose on the 3–5 costae above, unarmed beneath. Leaves 50–60 cm. long.

C. padangensis Furtado.

(bb) Leaflets 20–35 cm. long, 15 mm. wide, 2–3 cm. apart, setose on the lower surface,

unarmed on the upper surface or bristly on the three principal nerves in the terminal parts. Leaves 60–100 cm. long.

C. spectatissimus Furtado.

(AA) Leaves large, 2.5–5 m. long. Leaflets 2.5–4 cm. broad, 3–7 cm. apart, smooth on both surfaces, or occasionally bristly above along the primary nerves only.

(c) Leaves subcirriferous. Leaflets inequidistant, smooth on both surfaces. Primary spathes strictly tubular. Fruit fusiform.

C. longispathus Ridl.

(cc) Leaves not cirriferous. Leaflets equidistant, smooth on both surfaces, or occasionally bristly above along the principal nerves and along the margins. Primary spathes marcescent and lacerate in apical aparts. Fruit oblong or globose.

C. peregrinus Furtado.

ENUMERATION OF THE SPECIES

4. Calamus exilis Griff., Palms Brit. Ind. (1850) 51 t. 186 f. IV; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 454; Ridl. Mat. Fl. Mal. Pen. II (1907) 204; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 330 t. 130 et Appendix (1913) 55; Ridl., Fl. Mal. Pen. V (1925) 54.—**t. 4.**

C. ciliaris Bl. *sensu* Ridl. op. cit. (1907) 203 pro majore parte.

C. Curtisii Ridl. op. cit. (1907) 204 et (1925) 54.

Stem tufted, very slender, 1–2 cm. thick including leaf-sheaths, 10–15 m. long. *Leaf-sheaths* very scabrid, sometimes interpersed with large spines, usually brownish when dry. *Leaves* not cirriferous, 50–75 cm. long, sometimes 1–1·25 m. long, including 12–20 cm. long petiole; rachis bristly. *Leaflets* many, regularly set, 12–20 cm. long, 10–15 mm. broad, hairy on both surfaces. *Spadices* flagelliform, scabrid. *Fruit* oblong elliptic, 15–16 mm. long, 8 mm. in diam.; scales straw-coloured with brownish margins; seed oblong; albumen plicate-cerebriform.

MALAYA: Penang, Penang Hill, alt. 650 m. (Nauen 38,068). **Kemaman,** Ulu Bendong in Kajang, alt. 150 m. (Corner 30,069 & 30,152). **Pahang,** Telom (Ridley 13,914). **Perak,** Taiping Hills, alt. 800 m. (Ridley in Dec. 1908); Larut Hills (Anderson in III–1911); Maxwell's Hill (Burkill & Haniff 12,771). **Selangor,** Kuala Lumpur (Curtis 2,392, syntype of *C. Curtisii*); Semangkok Pass (Ridley in Aug. 1904, syntype of *C. Curtisii*); Ginting Simpah (Hume 8,509); Bukit Kutu (Ridley 7,883 as *Rotan Semiang*, syntype of *C. Curtisii*); Klang (Nur 8,343). **Malacca,** above Padang Batu on Mount Ophir (Ridley 10,118); Gunong Ledang (Ridley in 1892). **Johore,** Sungai Buloh Kasap (Corner 29,999); Sungai Sidili in Mawai (Corner 31,446 as *Rotan Lilin*); Mount Austen (Ridley in June 1904); Castlewood (Ridley in 1904); Gunong Pulai (Ridley 12,201).

Tab. 4. *Calamus exilis (A: Corner 29,999; B–E; Burkill & Haniff 12,771; F: Corner 30,069).*

A, Caudicis fragmentum cum spadice ♀ et folio. B, Spicula fructigerens. C. Fructus. D, Semen. E, Idem verticaliter discissum. F, Spadicis ♂ ramus cum spiculis.

The holotype of this species was collected in Gunong Ledang in Malacca under the vernacular name *Rotang Gonum*, a name not recorded again. Ridley (1925) says that the species is known as *Rotan Paku*.

The leaflets in the mountain collections are usually less hairy and more coriaceous than those in the low-land collections, and according to the description given by Beccari (1908) such mountain specimens appear to be typical of *C. exillis*. In the *Materials* (1907) Ridley has quoted such specimens under *C. exilis* and *C. Curtisii*, transferring to *C. ciliaris* all the specimens having papyraceous, much more bristly or hairy leaflets. However, as there are variations which are midway between these two extremes, I have not ventured to separate these forms into varieties. True *C. ciliaris* is a different species with globose fruits (vide infra). Semangkok (Selangor) and Pahang specimens have more spines on the leaf-sheaths; otherwise they are typical.

From the notes made by the collectors the species appears to be abundant in low wet places. It flowers when very young.

5. Calamus ciliaris Bl. var. **peninsularis** Furtado **var. nov.—t. 5.**

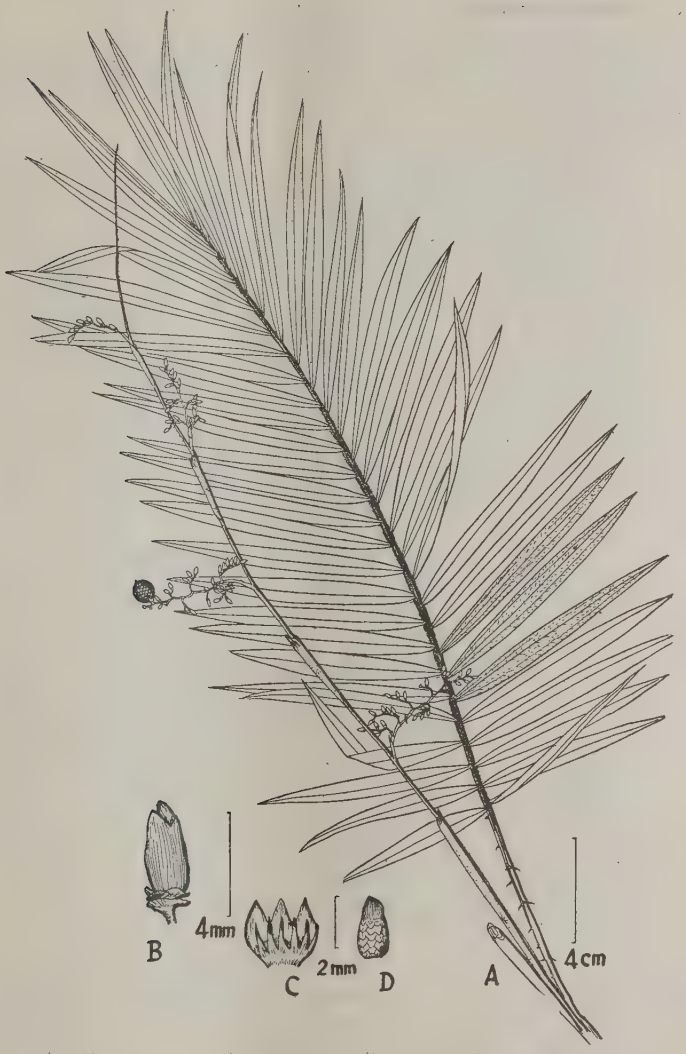
C. ciliaris Bl. *sensu* Ridl. in Trans. Linn. Soc. III (1893) 392, et Mat. Fl. Mal. Pen. II (1907) 203 quoad specimen tahanense infra citatum.

A forma typica javanensi differt foliis foliolisque majoribus et latioribus. Forma frondium C. exili *similes sed fructu globoso hoc taxon dissimillimum.*

Stem tufted, very slender, about 1 cm. thick, 5–7 m. long. *Leaf-sheaths* hairy, scabrid (occasionally with spinules ?). *Leaves* not cirriferous, 35–60 cm. long; rachis very bristly above. *Leaflets* many, regularly set, 8–12 cm. long, 8–10 mm. broad, conspicuously bristly on both surfaces. *Spadix* flagelliform, scabrid. *Fruit* roundish, 10–12 mm. in diam.; scales straw-coloured, paler along the margins; seed subglobose, plicate-cerebriform.

MALAYA: Pahang, Tahan River (Ridley in 1891).

This record definitely shows that a form of *C. ciliaris* occurs in the Peninsula. Ridley (1907) cited under the species a number of other specimens all of which belong to *C. exilis*. Beccari (Ann. Roy. Bot. Gard. Calc. XI Appendix, 1913 p. 55), who had an opportunity to examine many specimens of Ridley's *C. ciliaris*, did not see the above quoted specimen and so reduced the whole of *C. ciliaris* sensu Ridley to *C. exilis*. In his Flora (V, 1925 p. 54) Ridley was not able to distinguish this Pahang specimen from the others cited under *C. exilis* and so he followed Beccari's reduction. A specimen purported to be from Castlewood, Johore, but collected in 1905 from a plant cultivated in the Botanic Gardens in Singapore, appears to be this species, but the material is very imperfect.



Tab. 5. *Calamus ciliaris* var. *peninsularis (Ridley sn: Holotypus).*

A, Fragmentum caudicis cum folio et spadice. B, Flos femineus cum involucrophoro conspicue pedicellato ut involucrum et areola appareant. C, Idem apertus ut staminodia appareant. D, Ovarium.

6. Calamus padangensis Furtado **spec. nov.—t. 6.**

A C. exili *et* C. ciliari, *quibus valde affinis, haec species differt: vaginae spatio interaculeari, ocrea, folii petiolio rachideque, paginis foliolorum inferioribus, et axi spadicis, et spathis primariis haud hispidulis nec asperis.*

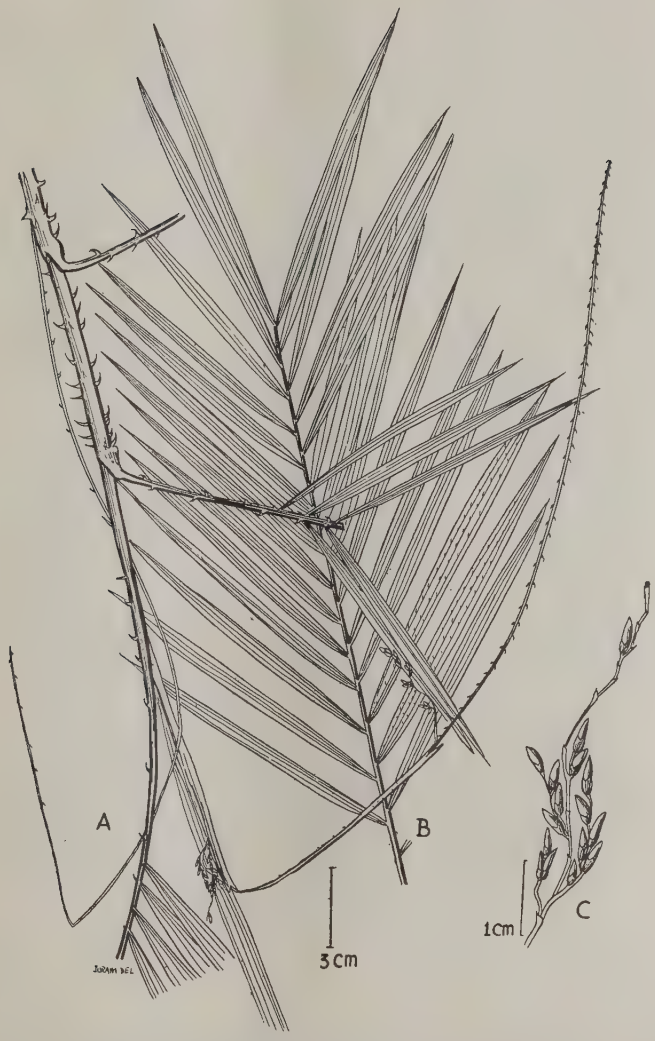
Caudex gracilis, caespitosus (?), cum vaginis circa 10 mm. in diam. *Vagina* striata, apice geniculata, in geniculo inermis, infra geniculum aculeis solitariis, remotissimis, 6–12 mm. longis, reflexis, basi superne tumescentibus, apicem versus valde angustatis armata, inter aculeos laevis, supra aculeos aculeiformiter sculpta. *Ocrea* brevissima, inermis. *Frons* circa 50 cm. longa; petiolus 7–16 cm. longus, deciduo furfuraceus, semi-teres, supra canaliculatus et inermis, subtus secus dorsum marginesque aculeis solitariis, reflexis, maximis circa 4 mm. longis remote praeditus; rachis deciduo furfuracea, supra inermis, subtus in dorso aculeis conformibus, reflexis, solitariis, remotis, basi interdum etiam secus margines ornata. *Foliola* equidistantia, aequalia vel fere, elliptico-linearia, subconcoloria viridia, usque ad 15 cm. longa, circa 8 mm. lata, 10–15 mm. inter se remota, subtus inermia et basi fusco furfuracea, supra secus costam medianam et 2–4 alteras costas subprimarias remote setulosa, secus margines inermia vel deciduo setulosa; duo foliola apicalia libera, valde divergentia. *Spadix masculus* unicus visus, filiformis, quam frondes minor (semper ?), in ramos duo divisus; axi et in spathis primariis aculeatus, haud hispidulus nec asperus.

Stem tufted (?), slender, about 10 mm. in diam. *Leaf-sheaths* gibbose at apex, armed remotely with 6–12 mm. long, reflexed, triangular spines, smooth and striate in the space between the spines, and with depressions to show the position occupied by the spines when enclosed by the lower sheath. *Ocrea* short, smooth, with no signs of roughness or hairs whatsoever. *Leaves* about 50 cm. long; petiole 7–16 cm. long, deciduously furfuraceous, channelled and unarmed above, armed along the dorsum and the margins with small, remote, upto 4 mm. long solitary, reflexed spines; rachis deciduously furfuraceous unarmed on the upper surface, provided on the dorsum with a row of small, solitary, remote spines becoming smaller in the distal portion, and with a few solitary spines also along the margins at the base. *Leaflets* many, equidistant, equal or almost so, up to 15 cm. long, about 8 mm. broad, 10–15 mm. apart, unarmed below, setose above on the midvein, and on one or more subprimary veins on each side of the midvein; margins unarmed or deciduously setose. *Male spadix* only one seen, shorter than the leaves, filiform, divided in 2 branches.

MALAYA: Trengganu, Gunong Padang meridionalis, ± 1300 m. alt. (Kiah & Moysey 33,376).

This species is a very close ally of *C. exilis* and *C. ciliaris,* more akin to the latter than to the former; but it is readily distinguished by the absence of any hairs or rough bulbous bases on leaf-sheaths, ocrea, petiole, spadix and spathes. The leaflets also do not show any hairs in the lower surface.

The plant may have been tufted, for the terminal ends of the two stems are represented in the collection, though both are very imperfect. The flagella develop when the plants are very young.



Tab. 6. *Calamus padangensis (Kiah & Moysey 33,376, holotypus).*
A, Caudicis fragmentum. B, Folii pars. C, Spadicis ramus masculi.

7. Calamus spectatissimus Furtado **spec. nov.—t. 7.**

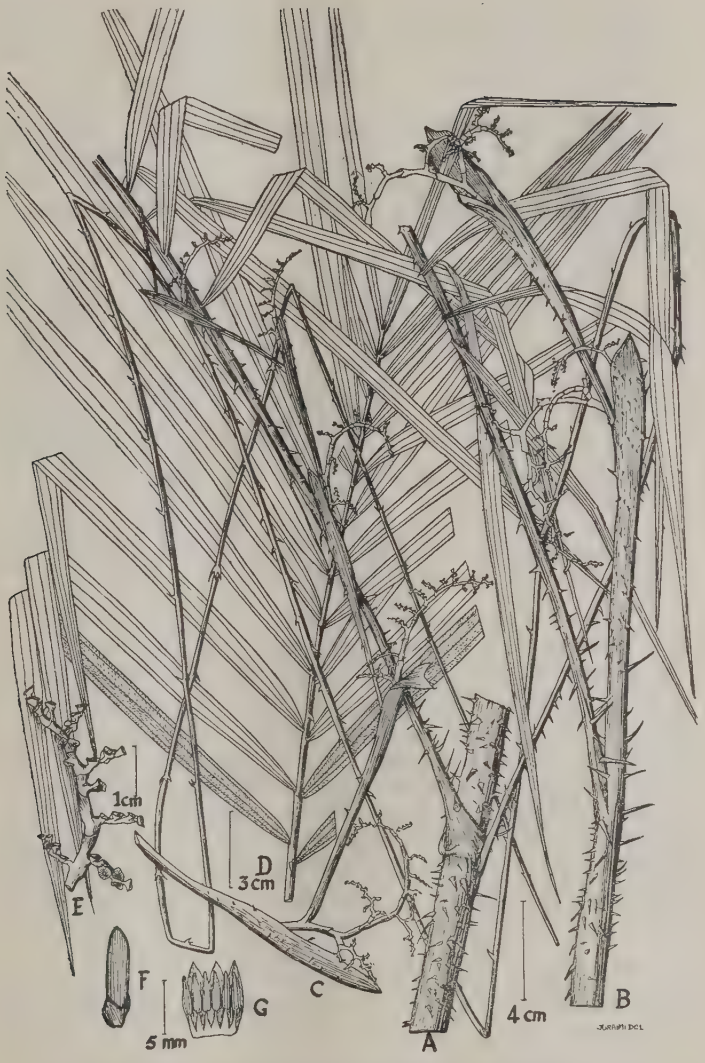
A C. exili *et* C. ciliari, *quibus proxima ut videtur, haec species differt frondibus longioribus, vagina frondali pilis vel setis carenti, foliolis multo majoribus utrinque inermibus vel paulo armatis. A Grege 10 Beccariano differt spathis apicem versus apertis, semicoriaceis, aculeatis, in apicem triangularem abrupte terminatis vel bilobatis.*

Caudex soboliferus, scandens, circa 6 m. altus, cum vaginis 10–15 mm. in diam. *Vagina* frondium aculeis altitudine variabilibus, maximis 15 mm. triangularibus reflexis, basi superne tumescentibus, inferne concaviusculis, minimis 1–3 mm. longis conformibus, horizontalibus vel reflexis, omnibus solitariis vel rarissime basi confluentibus armata, apice oblique truncata secus margines aculeis majoribus paucis remotis praedita, infra petiolum valde geniculata. *Frondes* cum petiolo 65–100 cm. longae, foliolis pluribus equidistantibus oppositis vel suboppositis circa 3 cm. inter se dissitis praeditae, dorso rachidis aculeis solitariis remotis reflexis armatae; petiolus 20–30 cm. longus, semiteres, secus margines aculeis 5–15 mm. remotis et in dorso aculeis solitariis remotissimis praeditus. *Foliola* 1–3 costulata, ensiformia, apicem versus sensim attenuata, 15–35 cm. longa, 10–15 mm. lata (duo apicalia inter minora libera) secus margines setosa, supra inermia vel interdum apicem versus secus costas primarias setosa, subtus secus costas primarias alterasque setosa. *Spadix masculus* 30–45 cm. longus, haud flagelliformiter appendiculatus, in ramis simplicibus vel compositis spiculiferentibus circa 6 divisus; rami 7–12 cm. longi, apicales simplices minores, basales compositi etiam in ramis secundariis divisi, omnes scorpioideo reflexi. *Spathae primariae* semi-coriaceae, plus minusve armatae, spadicum internodiis duplo vel sesquiplo longiores, basi laxiter tubulosae, supra apertae, in apicem triangularem abrupte terminatae vel breviter bilobatae; spathae secundariae tertiariaeque laxae, infundibuliformes, inermes, semi-coriaceae, usque ad 15 mm. longae. *Spiculae* usque ad 2 cm. longae, supra spatharum apicem axillantium remote orientes; spathellae infundibuliformes, inermes ligulatae. *Involucrum* cupuliforme paulo pedicellatum; flores masculi circa 10 mm. longi; corollae calycibus triplo longiores. *Spadix femineus* ignotus.

Stem scandent, tufted, about 6 m. long, 10–15 mm. in diam. *Leaf-sheaths* armed with scattered unequal spines, the longest 15 mm. long, and the shortest 1–3 mm. long. *Leaves* 65–100 cm. long including the 20–30 cm. long, petiole. *Leaflets* many, ensiform, equidistant, about 3 cm. apart, the largest 15–35 cm. long, 10–15 mm. broad. *Spadix,* male only seen, 30–45 cm. long, divided in about 6 spiculiferous, 7–12 cm. long branches. *Primary spathes* armed with scattered spines, longer than the internodes. *Spikelets* about 2 cm. long, arising above the axillant spathes; spathels unarmed; male flowers about 10 mm. long.

MALAYA: Perak, prope Kroh, in silvis Padang Chong dictis (Furtado 33,007, nom. vern. *Rotan Semut*).

This appears to belong to Beccari's Group X, but it is remarkably different because of the numerous long spines on the leaf-sheaths, aculeate and lax spathes which, moreover, have their limb extended much beyond the base of the axillary spadix-branches and which also terminate abruptly into a triangular apex. Female spadix and fruits are required before its affinity can be definitely settled. It is distinguished from *C. exilis* and *C. ciliaris*,



Tab. 7. *Calamus spectatissimus (Furtado 33,007—holotypus).*

A, Caudicis fragmentum. B, Vagina apicalis cum petiolo et spadice. C, Spadicis fragmentum apicale. D, Fragmentum folii apicale. E, Spadicis ramus secundarius. F, Flos masculus. G, Idem apertus ut dispositio staminum appareat.

to which it appears to be near, in that it has longer leaves, no hairs or setae on the leaf-sheaths, and its leaflets are longer and either armed on both sides or slightly armed beneath. The spadix is much smaller than in *C. peregrinus* and *C. longispathus.*

8. Calamus longispathus (*longispatha*) Ridl., Mat. Fl. Mal. Pen. II (1907) 209 pro parte (ex altera parte = *C. peregrinus* & *C. pallidulus* Becc.); emend. Becc. in Ann. Roy. Bot. Gard. Calc. XI Appendix (1913) 134 t. 78; Ridl., Fl. Mal. Pen. V (1925) 63 p.p.—**t. 8.**

Stem scandent, about 7–10 m. long, 3–5 cm. in diam., solitary (?). *Leaf-sheaths* obliquely truncate at mouth, light-coloured, armed with stout, scattered, solitary, reflexed spines about 5–8 mm. long. *Leaves* 2·50–3 m. long, usually ending in a short cirrus. *Leaflets* smooth on both surfaces, lanceolate-ensiform, acuminate, remote, 7 cm. or more apart, inequidistant, the largest 40–50 cm. long, 3–5 cm. broad, smallest and the narrowest towards the leaf apex. *Spadix* 2–2·5 m. long, not flagelliform, ending in a short, not unguiculate appendix, divided in about 4 spiculiferous, scorpioid, 14–20 cm. long branches. *Primary spathes* tubular, practically unarmed or armed with a few scattered, small spines. *Fruit* fusiform, not mature, 25 mm. long including 5 mm. long pedicelliform perianth, 8–10 mm. in diam; scales light coloured with brown margins.

MALAYA: Selangor, 15th mile Pahang Track near Semangkok Pass (Ridley 8.777 lectotype). **Pahang,** Gunong Sempang near Gap (Burn-Murdoch, sub Ridley No. 13,299, male). **Kemaman,** Ulu Bendong near Kajang, alt. 150 m. (Corner 30,076).

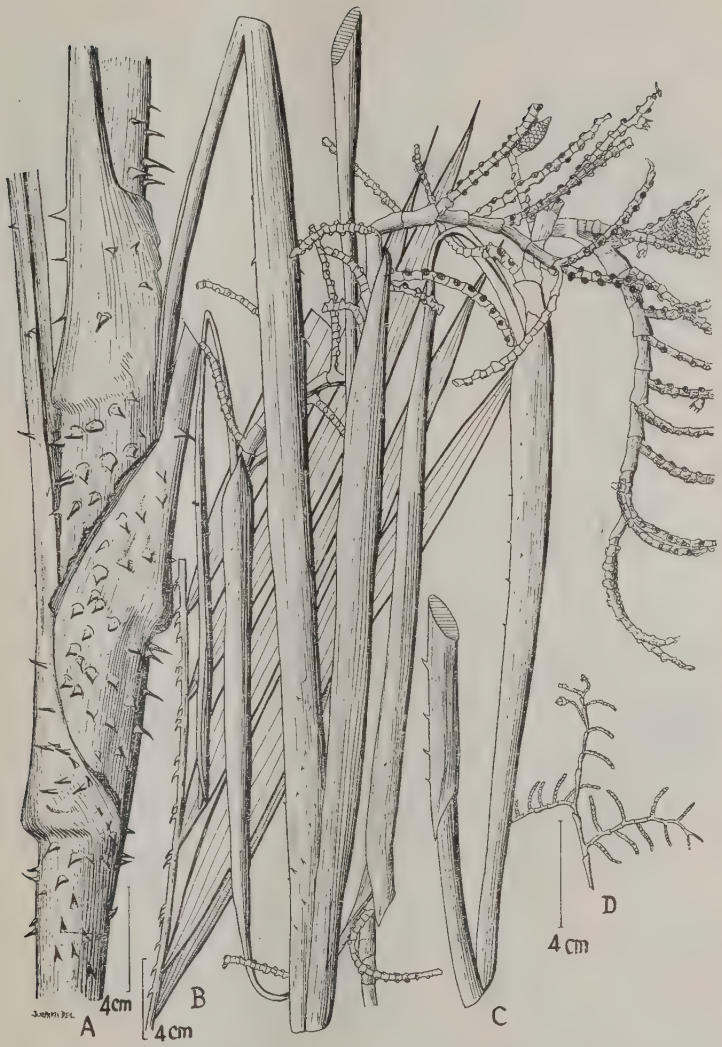
Ridley's original description of this species was based on more than one element; from the remarks made by Ridley, it looks as if the Gunong Ḳeledang syntype should have been chosen as the lectotype of the species, but the main body of the description was from the other syntypes also, and so I have followed here Beccari's typification of the species. In *Flora* cit. Ridley has adopted Beccari's typification and description of the species. The remarks attributed by Ridley to Beccari that the fruiting scales were obscurely channelled, referred to the Perak syntypes of Beccari's *C. pallidulus*, under which Ridley (1925) cites the specimens again without realising that he had made these also the syntypes of his *C. longispathus.*

9. Calamus peregrinus Furtado **spec. nov.—t. 9.**

C. longispatha Ridl., Mat. Fl. Mal. Pen. II (1907) 209 pro parte non typica.

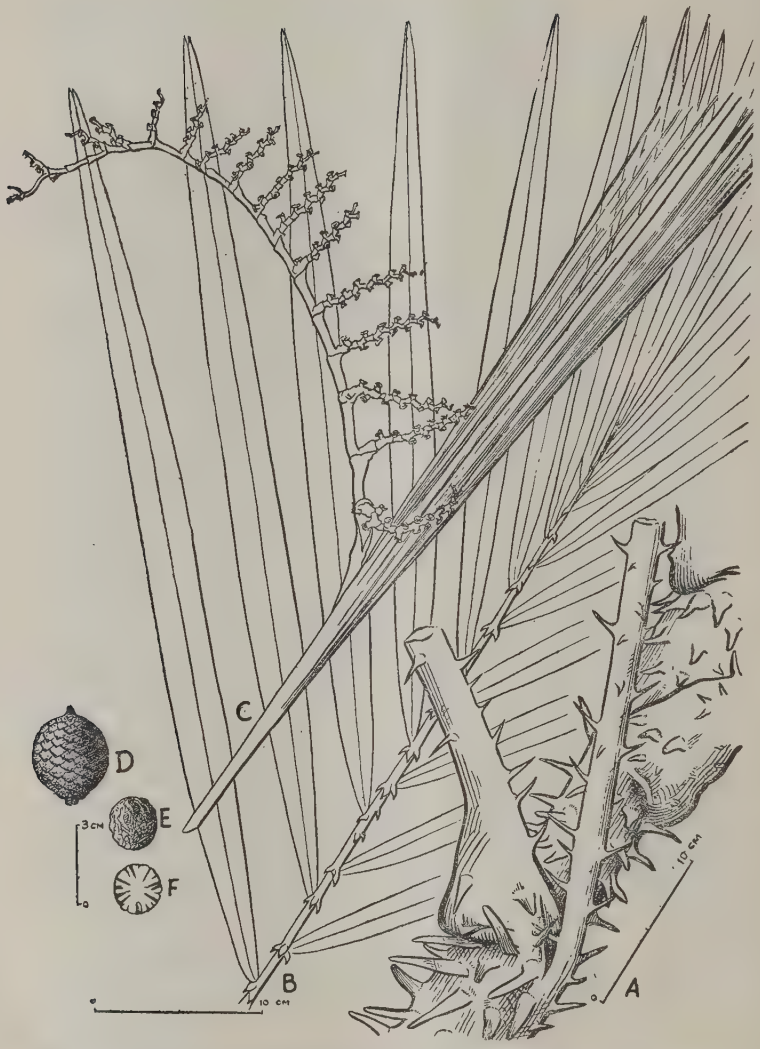
C. ornatus sensu Ridl., Mat. cit. (1907) 195 et Fl. Mal. Pen. V (1925 53 quoad specimina Moorhouseana infra citata.

Inter omnes species majores ad sectionem Macropodum *pertinentes spadicibus flagelliformibus longissimus; spathiis primariis*



Tab. 8. *Calamus longispathus (A–C: Corner 30,076; D: Burn-Murdoch 13,299).*

A, Caudicis fragmentum cum vaginis et spadice imperfecto. B, Fragmentum frondis. C, Fragmentum spadicis fructiferentis apicale. D, Spadicis fragmentum masculi ut spiculae appareant.



Tab. 9. *Calamus peregrinus (Furtado 33,035; holotypus).*

A, Caudicis fragmentum. B, Frondis fragmentum apicale. C, Spadicis fragmentum. D, Fructus. E, Ejusdem semen. F. Idem verticaliter discissum ut ruminatio et embryo appareant.

longis ultra ramorum bases axillarum longe productis mox marcescentibus et longitudinaliter fissis; fructibus inter majores ponendis circa 2·5 cm. in diam., globosis; haec species sat distincta. Ad Gregem VII Beccarianum pertinet.

Caudex solitarius, scandens, plus quam 20 m. longus, cum vaginis circa 3 cm. in diam. *Vagina* graminea, aculeis solitariis vel interdum lateraliter confluentibus triangularibus, usque ad 2 cm. longis, reflexis, subtus concaviusculis, apicem versus atrescentibus praedita, apice oblique truncata, infra petiolum valde geniculata. *Ocrea* brevissima mox decidua vix visibilis. *Frondes* magnae, longe petiolatae, cum petiolo 4–5 m. longae; petiolus gramineus, 1–1·75 m. longus, semiteres, superne applanatus, secus margines aculeis solitariis vel interdum binis ad 5 mm. longis, rarissime majoribus, reflexis, 1·5–3 cm. inter se remotis, subtus convexus, prope margines aculeis conformibus vel crassioribus per series 1–3 dispositis, in medio dorsi aculeis solitariis remotis, 3–7 cm. inter se dissitis ornatus; lamina 2·5–3 m. longa, in rachidi subtus unguibus per series 3 irregulares dispositis, solitariis vel interdum basi confluentibus, apicum versus nigrescentibus armata. *Foliola* numerosa equidistantia vel fere, opposita vel subopposita, 2·5–4 cm. inter se remota, ensiformia, apicem versus sensim attenuata, circa 50 cm. longa, ad usque 3·5 cm. lata, 1–3 costulata (apicalia minora), secus margines setosa, utrinque inermia vel supra in costis duabus lateralibus et subtus in costa mediana apicem versus tantum setosa, nervis transversalibus conspicuis. *Spadix femineus* in appendicem flagelliformem ungiculatam longam exeuns, in ramis primariis, spiculiferentibus, 3–6, deciduo furfuraceis, 20–25 cm. longis divisus, parte pedunculare ad ramum infimum usque ad 25–50 cm. longus. *Spathe primariae* tubulosae, ultra ramorum bases axillarum multo productae apice laminares, omnino vel pro majore parte marcescentes, fissae vel laceratae; basilaris spatha bicarinata, secus carinas et in altera parte dorsale praecipue in limbo aculeolata; alterae spathae basi cylindrinae fere inermes, in limbo aculeolatae; spathae secundariae cylindricae vel elongato infundibuliformes, 1–2 cm. longae, deciduo furfuraceae, apice truncatae, ligulatae. *Spiculae* usque ad 6 cm. longae, horizontales vel reflexae in axilla paulo callosae, floribus utrinsecus 6–8 praeditae; spathellae circa 4 mm. longae, ligulatae. *Involucrophorum* exsertum, pedicellatum, superne in axilla callosum rimatumque; involucrum pateriforme, vix exsertum; areola semi-circularis. *Perianthum fructiferum* conspicue pedicellatum, cum corollis quam calyces sesqui-longioribus. *Fructus* sine rostro 3–4 mm. longo et sine perianthio circa 30 mm. longus, 25 mm. latus; squamis per series verticales 17–18 dispositis, in juventute brunneis, serius partim flavescentibus, dorso canaliculatis, secus margines atrescentibus. *Semen* globosum, circa 16 mm. in diam., ruminationibus radiatim linearibus, usque ad 5 mm. profundis praeditum, in centro homogeneum. *Spadix masculus* in ramos secundarios spiculiferentes divisus, alioquid femineo similis.

Stem solitary, scandent, 15–25 m. long, 3 cm. in diam. *Leaf-sheaths* light straw-coloured, armed with scattered, upto 2 cm. long spines. *Leaves* non-cirriferous, 4–5 m. long including 1–1·75 m. long petiole. *Leaflets* many, equidistant, 2·5–4 cm. apart, ensiform, the largest 50 cm. long, 3·5 cm. broad; claws on the rachis solitary or sometimes united at base, darkish at the apex, arranged in 3 irregular series. *Spadix* long, flagelliform; female divided in about 3–6 spiculiferous, 20–25 cm. long branches; male decompound bearing spikelets on secondary branches; primary spathes tubular with a long, laminar apex, later decomposing and splitting. *Fruit* about 30 mm. long, 25 mm. in diam.; scales brown when young, straw-coloured when old, with dark margins, channelled in the middle; seed globose, about 16 mm. in diam., radiately ruminate with a broad homogeneous centre.

MALAYA: Kedah, Weng (Furtado 33,063); Weng in colle Bukit Seblah (Furtado 33,064); Baling prope Sungai Labong (Furtado 33,061); Langkawi Islands (Batten-Pooll in II–1940). **Perak,** Bukit Merbau Balong prope Kroh (Furtado 33,035 femineus, *holotypus*, et 33,035[a] masculus); in silvis Padang Chong dictis, prope Kroh (Furtado 33,013, nom. vern. *Rotan Manau Tikus*); Gunong Keledang (Ridley in IX–1898, syntypus *C. longispathi*). **Negri Sembilan,** Bukit Senaling prope Kuala Pilah (Moorhouse, 24–XII–1903, vern. nom. *Rotan manok,*); Kuala Pilah (Moorhouse in 1907); Gunong Tampin (Burkill 2,536).

C. peregrinus has conspicuously pedicellate involucrophores and fruiting-perianths, and its spathe limb is long and lacerate and extends much beyond the base of the axillary spadix-branches, characters which would make the species fall in Beccari's Group VII which so far consisted of two Indian species only; but the seed of these two species apparently has only superficial ruminations.

The holotype specimen does not have any fully developed fruits and so the above-given description of the fruit is derived from Moorhouse's specimen collected in 1903.

Sectio III. RHOMBOCALAMUS Furtado **sect. nov.**

Caudices caespitosi (semper?), scandentes, flagelliferi. *Folia* ecirrifera vel cirro abortivo brevissimo praedita. *Foliola* rhomboidea, plerumque bicoloria, pluricostulata, cum costa mediana tantum ad apicem folioli attingente, alteris costis altitudine diversa evanescentibus. *Spadices* flagelliformes, quam folia nonnihil longiores, in ramos floriferentes secundarios vel tertiarios divisi. *Spathae* primariae et alterae stricte tubulares. *Spiculae* sessiles. *Involucrophora* sessilia. *Perianthium fructiferum* pedicelliforme or subpedicellatum. *Semen* superficialiter vel profunde ruminatum.

DISTRIBUTIO: In Java, Sumatra, Borneo, Peninsula Malayana et in Indo-China incolunt.

SPECIES TYPICA: *C. mawaiensis.*

This section is equivalent to Beccari's Group XI, and includes only the species of Calamus having rhomboidal leaflets. As in the section of *Coleospathus*, the species of this section bear flagella on the leaf-sheaths, no cirrus or only an abortive cirrus at the apex of each leaf, tubular primary spathes, and sessile spikelets and involucrophores. The fruiting perianth is subpedicellate or pedicelliform.

The species of this section of Calamus are not well represented in the herbarium collections and so are very imperfectly known. Most of the species appear to be tufted, and from the observations made on the clumps at the Botanic Gardens, Bogor, Java, and also in the jungle, the species do not appear to flower freely. Good collections are needed to show also the range of variation within each species.

Sterile specimens of this section of Calamus may be readily recognized from the rhomboidal-leaflet bearing species of Korthalsia by the flagelliferous leaf-sheaths and geniculated petiole-bases, two characters not found in the species of Korthalsia. The species of the genus Ceratolobus which have rhomboidal leaflets and geniculated petiole-bases are recognized, in the sterile stages, by the long cirrus at the end of the leaves, whereas a long cirrus is not found in any of the Calamus species having rhomboidal leaflets.

Key to the Species

A. Leaflets 7–9 costate, not ansate (pseudo-stalked) or obscurely ansate. (Ocrea large, 4–5 cm. long). Leaf-sheaths, leaf-rachis and spadix-axis densely floccose, drying yellowish. (Fruit globose or ovate).

C. tomentosus Becc.

AA. Leaflets 5–7 costate, conspicuously ansate. (Ocrea 1 cm. long or less). Leaf-sheaths, leaf-rachis and spadix axis thinly scaly, and often covered with tobacco coloured deciduous scurf, drying darkish.

B. Fruit globose or ovate. (? Leaf-sheaths armed with sharp spines with mammiform bases. Ocrea.....).

C. Blumei Becc.

BB. Fruits oblong-obovate. (Ocrea 4–5 mm. long. Leaf-sheaths provided with mammiform warts without sharp spines).

C. mawaiensis Furtado.

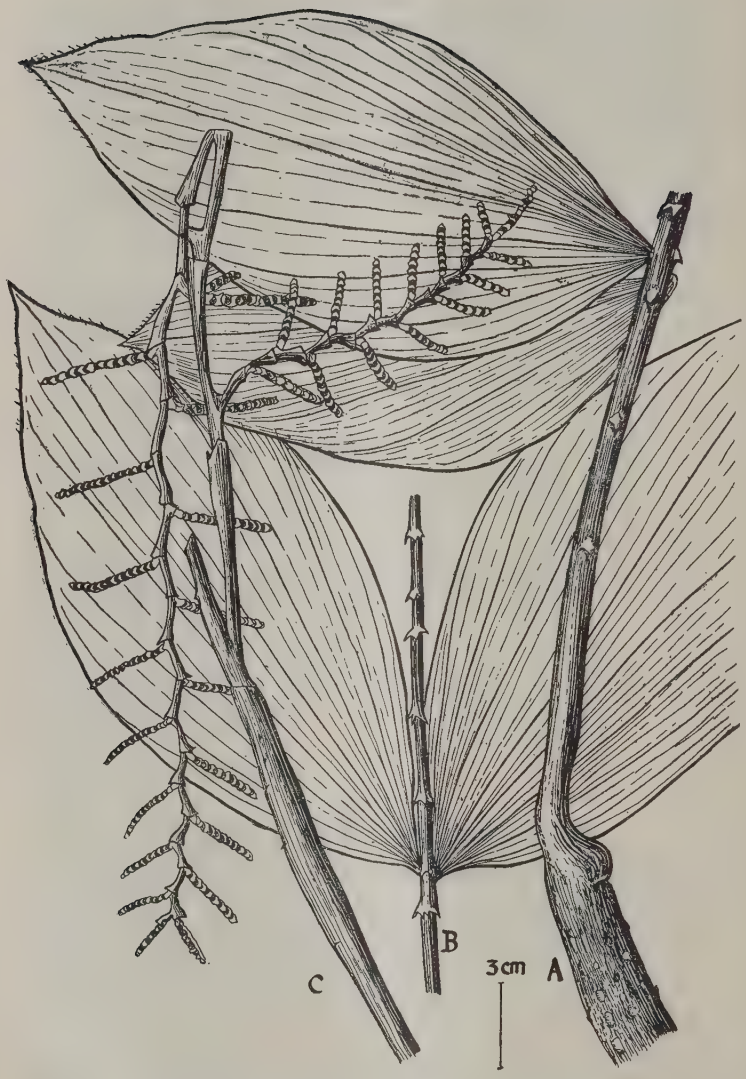
ENUMERATION OF THE SPECIES

10. Calamus tomentosus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 455 and in Ann. Roy. Bot. Gard. Calc. XI (1908) 338 t. 135; Ridl., Fl. Mal. Pen. V (1925) 52 pro parte (ex altera parte = *C. Blumei*), (non *C. tomentosus* sensu Becc. in Ann. cit. XI Suppl. (1913) 61 t. 31 = cf. *C. Slootenii*).—**t. 10.**

C. Blumei Becc. *sensu* Becc. in Ann. *cit.* Suppl. (1913) 63 t. 33.

C. rhomboideus Bl. *sensu* Ridl., Mat. Fl. Malayan Pen. II (1907) 194 pro parte (ex altera parte = *C. Blumei*).

Stem tufted (?), scandent, 10–15 m. long, 1·5–2·5 cm. in diam. *Leaf-sheaths* densely yellowish floccose, armed with very short mammiform warts having at their apices sharp, ascendent spines, gibbose



Tab. 10. *Calamus tomentosus (Ridley 11,410).*
A, Frondis fragmentum basale. B, Frondis fragmentum mesiale. C, Spadicis pars masculi.

below the petiole-base, flagelliferous. *Leaves* apparently not very long, non-cirriferous or terminating in a very short abortive, about 1 cm. long cirrus; petiole 12–40 cm. long, sparsely armed with scattered, black-tipped, solitary claws, densely floccose-tomentose; rachis similarly floccose, armed underneath with ternate claws. *Leaflets* opposite or subopposite, remote, 8–15 cm. apart, broadly-elliptic, rhomboidal, or sometimes slightly ovoid, 20–35 cm. long, 12–18 cm. broad, with 7–9 divergent costae. *Female spadix* long, flagelliform, armed with strong claws, densely yellowish, floccose tomentose in the axis and spathes, with 20–50 cm. long branches, each branch bearing 5–6 cm. long spikelets. *Fruits* sphaerical, 20–22 mm. in diam., beaked; scales uniform, amber brown, arranged in 18 series with darker margins. *Seed* with deeply ruminate albumen. *Male spadix* ultra-decompound, male flowers borne on the secondary and tertiary branchlets.

MALAYA: Perak, Taiping Hills, above Maxwells Hill (Ridley 11,410, male spadix).

BORNEO: Liang-gagan (Hallier 2,786).

This species was based on the syntypes collected in Perak. The description of the fruit is from the Bornean specimen quoted by Beccari under *C. Blumei*. Ridley 11,410 is the basis of the description of the male spadix given here. The indumentum consists of yellowish scales arranged very thickly on leaf-sheaths, petiole and leaf-rachis.

11. Calamus Blumei Becc. in Rec. Bot. Surv. Ind. II (1902) 209 (nomen), in Ann. Roy. Bot. Gard. Calc. XI (1908) 340 t. 137 haud in Ann. *cit.* Supl. (1913) 63 7. 33; Merr., Enum. Born. Pl. (1921) 73.—**t. 11.**

C. rhomboideus Bl. *segmentis rigidioribus* Bl., Rumphia III (1847) 60.

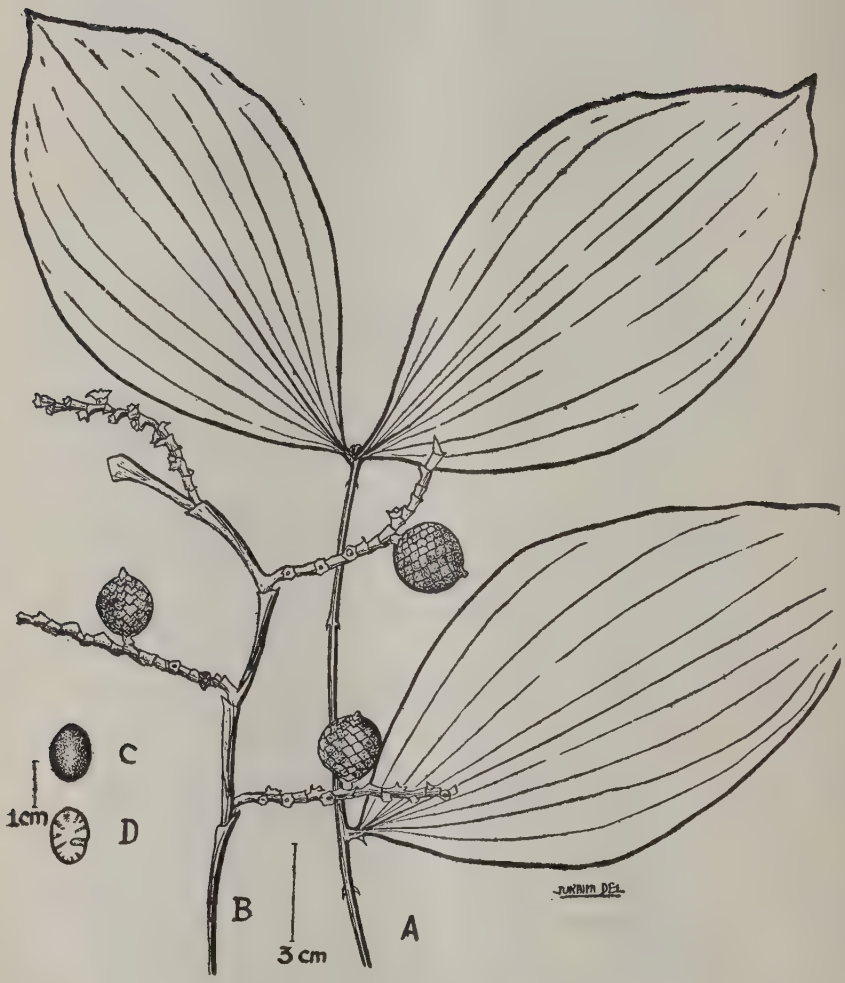
C. rhomboideus Bl. *sensu* Miq., Anal. Bot. Ind. I (1850) 6; Ridl., Mat. Malayan Pen. II (1907) 194 pro parte.

C. tomentosus sensu Becc. in Ann. cit. Suppl. (1913) 62 t. 32.

C. tomentosus Becc. var. *korthalsiaefolius* Becc. in Rec. Surv. Ind. II (1902) 209 (nomen), in Ann. cit. XI (1908) 340 t. 136; Ridl., Fl. Malay Pen. V (1925) 52: **syn. nov.**

? *C. tomentosus* Becc. var. *intermedius* Becc. in Ann. cit. XI (1908) 340; Ridl., Fl. *cit.* V (1925) 52.

Stem tufted, scandent, 10–15 m. long, 8–12 mm. in diam. *Leaf-sheaths* glabrous or thinly covered with deciduous scales which are often confluent (when young also covered with dark brown deciduous scurf), armed very sparingly with small ascendent spines with tuberculiform bases, gibbous below the petiole. *Leaves* about 60 cm. long and petiole about 10 cm. long; rachis armed with solitary or geminate claws beneath; cirrus abortive or none; both rachis and petiole darkish when dry, glabrous or partially covered with deciduous scales and sometimes brownish scurf. *Leaflets* 17–19 cm. long, 7–9 cm. broad, 5–7 costate, with no (deciduous?) cilia in margins or apex. *Spadix* female only known, with one spikelet bearing branch about 30 cm.; larger spikelets about 6–7 cm. long; secondary spathes 3–3·5 cm. long,



Tab. 11. *Calamus Blumei (Alvins 2,253).*

A, Frondis fragmentum apicale. B, Spadicis pars cum fructibus. C, Semen. D, Idem verticaliter discissum ut ruminatio et embryo appareant.

tubular, deciduously scaly. *Involucrophore* cupular with no callus in the axil between it and the upper spathel. *Fruiting perianth* pedicelliform. *Fruit* globose or ovoid, without the beak and perianth 18–19 mm. long, 16–17 mm. in diam.; scales dull brown, with slightly paler margins, arranged in 18 series. *Seed* deeply ruminate.

MALAYA: Negri Sembilan, in Sungei Ujong, probably at Bukit Tumiyang (Alvins 2,253, vern. nom. *Rotan Tai Ayam*).

BORNEO: prob. Dunsun River (Korthals).

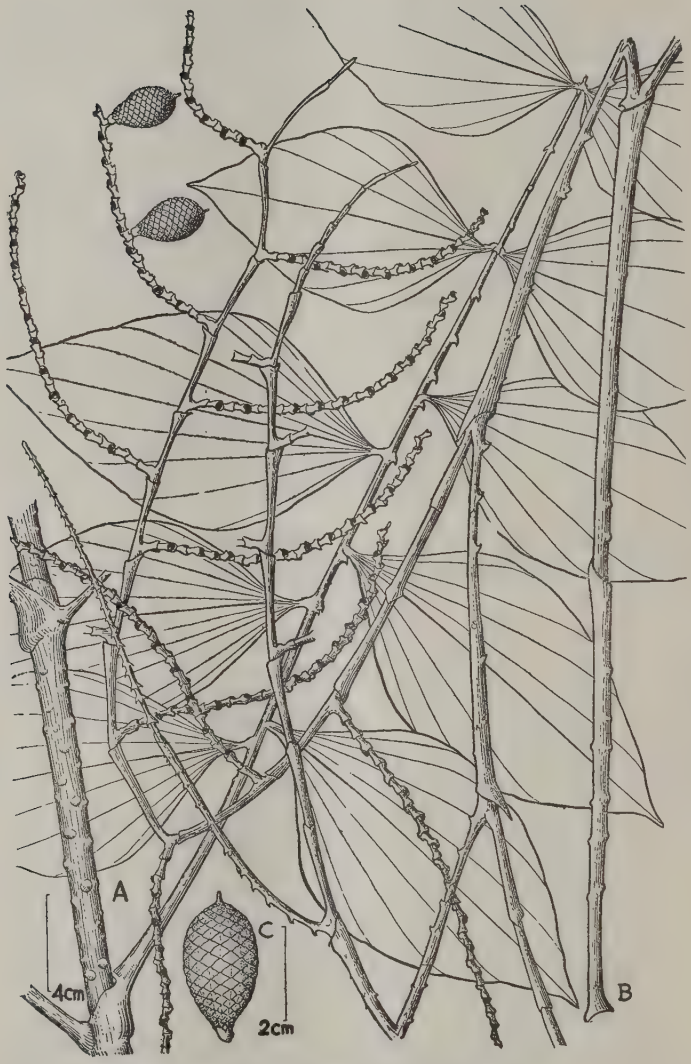
I have not seen the type of this species which is the above quoted Korthals' specimen, but there is a good plate and description given of it by Beccari. The Negri Sembilan specimen, collected by Cantley's collector Alvins (duplicate of it has been cited and figured by Beccari (1913) under *C. tomentosus*) agrees well with *C. Blumei*. Perhaps the Malayan specimens were referred by Beccari to *C. tomentosus* on geographical grounds and so there was a need for making the varieties. The leaflets in the latter are hardly ansate and bear 7–9 costae, and its leaf-sheaths, leaf-rachis and spadix dry yellowish and densely floccose. The leaflets in *C. Blumei* are 5–7 costate and distinctly ansate, and the leaf-sheaths, leaf-rachis and spadix are thinly scaly and tend to be dark, when dry. Also the leaflets and the fruits are apparently smaller in the latter.

Apparently here belongs also Teijsmann's specimen Beccari (1913, p. 61) described in the observations made under *C. tomentosus*.

12. Calamus mawaiensis Furtado **spec. nov.—t. 12.**

C. tomentoso *valde affinis, sed verrucis vaginae mammiformibus, haud acutis; foliolis conspicue ansatis brevioribusque; fructibus oblongo-obovatis maioribus; involucrophoris superne callosis; vaginis, petiolis, frondium rachidibus, et axibus spadicum in sicco atrescentibus haec species sat distincta.*

Caudex scandens, caespitosus (?), circa 10 m. longus, circa 15 mm. in diam. *Vaginae* frondales lepidibus gracilibus albescentibus deciduis, furfuro deciduo fusco, verrucis mammiformibus haud pungentibus praeditae, infra flagellum (circa 1 m. longum) carinatae. *Ocrea* coriacea, inermis, 4–5 mm. longa, oblique truncata, margine scariosa. *Frondes* cum petiolo circa 10 cm. longo, supra canaliculato, inermi vel secus dorsum marginesque verrucis conformibus armato, circa 45 cm. longae, foliolis in specimine viso utrinsecus 5; rachis similimodo lepidota, dorso unguibus 1–3 digitatis apice fuscis praedita. *Foliola* in rache utrinsecus 5; duo apicalia opposita, minima, ambitu irregulariter rhomboidea; altera tria majora, subopposita, majora, ad 17 cm. longa, 9 cm. lata, rhomboideo-elliptica, utrinque sensim attenuata, apice acuto-acuminata, basi ansata, supra cinereo viridescentia, subtus brunnescentia, utrinque polito-levigata, inermia, secus margines undulata haud setosa, nervis 5–7. *Spadix femineus* in specimine viso metralis cum pedunculo 30 cm. longo, in appendicem 25 cm. longum terminatus, in axi unguibus basi tumidis solitariis vel 2–3 digitatis armatus; inflorescentiae partiales 4, in axilla callosae, porrectae 30–60 cm. longae, spiculis utrinsecus 3–6 praeditae. *Spathae* primariae tubulosae,



Tab. 12. *Calamus mawaiensis (Kiah s.n.—holotypus).*
A, Caudicis pars ut vaginae, petiolus et foliola appareant. B, Spadix cum fructibus. C, Fructus.

lepidotae, aculeatae, apicem versus inermes vel parce aculeolatae, oblique truncatae, ligulatae; spathae secundariae 3–4 cm. longae, elongato-infundibuliformes, ligulatae, lepidotae, inermes vel parcissime aculeolatae. *Spiculae* exsertae, in axilla valde callosae, horizontales vel deflexae, 10–15 cm. longae, utrinsecus floribus 10–14; spathellae 6–7 mm. longae, infundibuliformes, ligulatae. *Involucrophorum* cupuliforme, aliquantulum infra spathellae apicem oriens, superne ad spathellam superiorem adnatum, plerumque in axilla callosum; involucrum cupuliforme, in uno latere paulo exsertum; areola lunata. *Perianthium fructiferum* pedicelliforme. *Fructus* immaturi obovato-oblongi vel obovato-elliptici (sine rostro 3 mm. longo) circa 25 mm. longi, 16 mm. in diam.; squamis per orthostichies 18–20 dispositis, sordido-stramineis, concoloribus. *Semen* immaturum oblonge-obovatum, profunde ruminatum ut videtur.

Stem tufted (?), scandent, about 10 cm. long, about 1·5 cm. in diam. *Leaf-sheaths* thinly covered with deciduous confluent scales, and provided with blunt, mammiform warts. *Leaf* only one seen, 45 cm. long with 10 cm. long petiole, armed in the lower surface of the rachis with 1–3 digitate claws; scaly in the petiole and the rachis. *Leaflets* 5 on each side, rhomboidal or rhomboidal-elliptic, 5–7 costate, ansate, the terminal two pairs opposite, the other three sub-opposite, the largest about 17 cm. long, 9 cm. broad. *Spadix*, only one female seen, flagelliform, about a metre long, divided into 4 spikelet-bearing branches, each about 30–60 cm. long. *Spathes*, primary and secondary strictly sheathing, scaly; spikelets 10–15 cm. long. *Fruit* immature, obovate-oblong or obovate-elliptic, about 25 mm. long (without 3 mm. beak), 16 mm. in diam.; scales concolorous, dirty straw coloured, arranged in 18–20 series; seed not in a definitive stage, probably deeply ruminate.

MALAYA: Johore, prope Sungai Kayu in loco paludoso (Kiah 12–3–1937).

In the characters of its leaves and spikelets, this species appears to be a very close ally of *C. tomentosus* as interpreted here, but the absence of thick tomentum and of the sharp spines on the leaf-sheaths, the ansate leaflets, the longer spikelets, the callosity in the upper axil of the involucrophore, and larger obovate fruits distinguish *C. mawaiensis* from that species. *C. Blumei* which has 5–7 costate leaflets and which dry blackish like *C. mawaiensis* has smaller, globose fruits, conspicuously sharp spines on the leaf-sheaths (apparently), and no callosity in the upper axil of the involucrophore. *C. Slootenii*, which has also oblong fruits, differs from *C. mawaiensis* in the sharp spines on the leaf-sheaths, more elongate elliptic leaflets, shorter spikelets ovoid oblong fruits having more series of scales, and tobacco coloured deciduous scurf on the surface of leaf-sheaths, leaf-rachis and spadix.

Species non-Malayanae novae

The following two new non-Malayan species belonging to this section are based on the specimens found in the Singapore herbarium.

Tab. 12 (*a*). *Calamus penibukanensis (Clemens 40,520—holotypus).*
A, Caudicis pars cum folio et spadice masculo. B, Caudicis pars ut folii geniculus et flagellus appareant.

12. (a) Calamus penibukanensis Furtado **spec. nov.—t. 12 (a).**

C. rhomboideo *cui valde affinis, haec species differt omnino deciduo fusco furfuracea, frondium vaginis magis armatis, ocreis longioribus, petiolis brevioribus, foliolis conspicue ansatis.*

Leaf-sheaths striate, not scaly, armed with distant ascendent spines having swollen bases. *Ocrea* 1–1·5 cm. long. *Leaf* without petiole 55–60 cm. long; petiole 5–6 cm. long. *Leaflets* 9–12 costate, distinctly ansate. *Male spadix* 1 m. long, ultra-decompound, weakly clawed in the axis, ending in a short clawed appendix; primary branches 5–6, flowers borne on secondary and tertiary branchlets. *Primary spathes* prickly on the dorsal side.

Leaf-sheaths, petiole, leaf-rachis and spadix with its spathes deciduously covered with tobacco coloured scurf, under which the parts dry greenish yellow.

BORNEO: Mt. Kinabalu, prope Penibukan, alt. ± 1250 m. (Clemens 40,520).

12. (b) Calamus Slootenii Furtado **spec. nov.—t. 12 (b).**

C. Blumei *et* C. mawaiensi *proxima, a quibus haec species recedit: vaginis frondium et rachidibus valde scabridis, foliolis utrinque arcuatim attenuatis; a* C. Blumei *differt etiam ocreis minoribus, et a* C. mawaiensi *aculeis vaginae pungentibus, filiolis majoribus, involucrophoris in axilla supra haud callosis.*

Stem caespitose, ± 10 m. long, 2·5 cm. in diam. *Leaf-sheaths* scabrid, covered with whitish scales and deciduous tobacco-coloured scurf over the scales, armed with ascendent short, sharp thorns with large tuberculiform bases. *Ocrea* 1–2 cm. long, deciduous. *Leaves* rachis 70–80 cm. long, including 20–25 cm. long petiole, scabrid, covered with whitish scales and with tobacco-coloured deciduous scurf over them, armed with strong, 1–3 digitate claws. *Leaflets* bicoloured, elliptic, 20–25 cm. long, 7–8 cm. wide, distinctly ansate at base, acuminate and ciliate at apex, dark-furfuraceous when young. *Female spadix* long, flagelliform, 2–3 branched, ending in a flagelliform appendix; peduncle ± 80 cm. long, branches 18–20 cm. apart, 25–35 cm. long, with 6–7 alternate spikelets one each side.

All the parts tend to become dark when dry.

BORNEO: in Horto Botanico Bogoriense sub XII. C. 114 culta (legit Furtado sub numero 30,906).

Here apparently belongs Hewitt's specimen described by Beccari under *C. tomentosus* in Ann. Roy. Bot. Gard. Calc. XI Suppl. (1913) 61 t. 31, whose fruits are described to be broadly ovoid, 26–28 mm. long, 23 mm. broad, having the scales arranged in 21 vertical series. Teijsmann's specimen described by Beccari (1913) in the observation made under the same species is apparently *C. Blumei.* Here may also belong Cuadra A250, a sterile specimen collected at Masuri near Ulu Segama in Lahad Datu district of British North Borneo.

Tab. 12 (*b*). *Calamus Slootenii (Furtado 30,906—holotypus).*
A, Caudicis fragmentum cum petioli geniculo. B, Fragmentum caudicis apicale cum folio et spadice femineo.

The species is named after the late Dr. D. F. Van Slooten who, as the Director of the Botanic Gardens, Bogor, Java, had given me facilities to make specimens of the palms cultivated in the Gardens. The species was cultivated as Korthalsia and probably many specimens have been distributed under the name. The duplicates of my collection have been distributed as *C. Blumei.*

IV. Sectio PHYLLANTHECTUS Furtado **sectio nov.**

Phyllanthectae Ridl., Mat. Fl. Mal. Pen. II (1907) 190 et Fl. Mal. Pen. V (1925) 49 pro parte.

Calamoxleya H. A. Barttett (subgen.) in Pap. Mich. Sci. Arts Lett. XXV (1939) 7.

Frondes longe vel breviter cirriferae, sine cirro spadicibus longiores vel eis aequilongae. *Vaginae* frondium non flagelliferae. *Spadices* ramis distantibus praediti, interdum breviter appendiculati. *Spathae* primariae stricte tubulares. *Spiculae* sessiles. *Involucrophora* sessilia.

DISTRIBUTIO: Indo-Malesia (Sikkim in Himalayas, Andamans, Nicobar, Burma, Indochina, Malaya, Sumatra, Java, Borneo, Philippines, Celebes, Moluccas, up to New Guinea).

This section includes all the species which are characterised by their sessile spikelets and involucrophores, tubular spathes, non-flagelliform spadices, non-flagelliferous leaf-sheaths, and in climbing plants conspicuously cirriferous leaves. The spadices in the species of this section are erect or almost so, and are generally shorter than the leaves, and have no special hooks adapted for climbing. In some species, especially of the subsection *Cirruliferus* the cirrus may not be properly developed and instead the leaves may be imparipinnate, subcirriferous or shortly cirriferous.

This section corresponds to Beccari's Group XV.

(a) Subsectio: PHYLLANTHECTUS.

Caudex crassus. *Frondes* longae, spadicibus multo longiores, longe cirriferae, foliolis fasciculatis vel non, praeditae. *Spadices* crassi, robusti, unguibus validis armatissimi, pro rata breviter pedunculati. *Perianthium fructiferum* pedicelliforme vel subpedicelliforme, rarissime explanatum.

DISTRIBUTIO: Indo-Malesia.

SPECIES TYPICA: *C. palustris.*

Key to the Species

A. Sheathed stems slender, less than 3 cm. thick. (Petiole long or obsolete. Leaflets linear and fascicled, or inequidistant, or pluricostulate, equidistant, inequidistant, or geminate, in one species glaucescent. Fruiting perianth pedicelliform or explanate).

B. Petiole long, 15–60 cm. long. (Fruiting perianth pedicelliform).

(a) Leaf-sheaths thickly armed with long black spines, some as long as 3 cm. Petiole 30–60 cm. long. Leaflets 3– costate, setose above, less than 2 cm. wide, ensiform, often in groups, sometimes equidistant. Stems short. Fruits small, about 10 mm. in diam.

(b) Fruits round or globose; scales yellow

C. Oxleyanus T. & B. var. **Oxleyanus.**

(bb) Fruits obovate-oblong; scales yellow

C. Oxleyanus var. **obovatus** Becc.

(bbb) Fruits ovate or oblong; scales dark brown

C. Oxleyanus var. **montanus** Furtado.

(aa) Leaf-sheaths armed with brown, distant up to 2 cm. long spines. Petiole 12-25 cm. long. Leaflets pluricostulate, elliptic, unarmed, more than 4 cm. wide, never in groups, but inequidistant. Stems long. Fruit large, about 3 cm. long and 2 cm. in diam.

C. simplex Becc.

BB. Petiole in adult leaves obsolete, or when present less than 10 cm. long.

(c) Petiole and the basal portion of the rachis broad and flat in the upper surface and also armed with erect spines. (Fruiting perianth subpedicelliform or almost so).

C. palustris var. **malaccensis** Becc.

(cc) Petiole and rachis base deeply channelled and unarmed above (except along the margins).

(d) Fruiting perianth conspicuously pedicellate.

(e) Leaflets whitish beneath, inequidistant, often arranged in distant pairs. (Involucrophore exsert, almost subpedicelliform).

C. caesius Bl.

(ee) Leaflets not whitish beneath, equidistant or inequidistant, but not in distinct pairs in the lower half of the leaf. (Involucrophore flattish, not subpedicelliform).

C. pallidulus Becc.

(dd) Perianth deeply divided, not pedicellate.

(f) Leaflets distant, solitary in the lower half, inequidistant or often geminate in the upper (Involucre deeply cup-shaped. Fruiting perianth broadly companulate in the undivided base).

C. axillaris Becc.

(ff) Leaflets inequidistant and often geminate in the lower half of the leaf also.

(g) Involucre deeply cup-shaped. Fruiting perianth companulate, divided almost to the base, at least on one side. Fruit scales in 23–26 vertical series.

C. Hendersonii Furtado.

(gg) Involucre shallow, saucer-shaped. Fruiting perianth urceolate with truncate base. Fruit scales in 15–16 vertical series.

C. riparius Furtado

AA. Sheathed stems more than 4 cm. in diam. (Petiole 6–40 cm long. Leaflets large, pluricostulate, sometimes fascicled, or almost regularly placed, glaucescent beneath. Fruiting perianth pedicelliform, or not?).

B. Leaf-sheath unarmed at the mouth, otherwise armed with distant, solitary, woody, brownish spines; abruptly swollen into a semi-annular geniculum. Petiole unarmed above except along the margins. Leaflets inequidistant, often geminate even in basal

half of the leaf. Involucre obliquely cupular, included (sessile); areola horizontally developed slightly exsert.

C. tumidus Furtado.

BB. Leaf-sheath strongly armed all over with blackish, often confluent spines, as also at the mouth and in the geniculum; the latter swollen in a V-shaped gibbosity. Petiole armed above. Leaflets subsequidistant, not in groups. Involucre shallow, exsert; areola laterally excavate.

(a) Leaf-sheaths brownish, thickly armed with approximate or confluent spines. Leaflets often adpressedly spinulose along the margins. Involucrophore exsert.

C. Manan Miq.

(aa) Leaf-sheaths yellowish, armed with a fewer, practically non-confluent spines. Leaflets not spinulous along the margins. Involucrophore almost included.

C. giganteus Becc.

ENUMERATION OF THE SPECIES

13. Calamus Oxleyanus Teysm. et Binn., Cat. Pl. Hort. Bogor. (1866) 75 nomen tantum; Miq., De Palmis Archip. Ind. Obs. Nov. (1868) 17 et tab.; Becc. in Hook., f., Fl. Brit. Ind. VI (1893) 458; Ridl., in Journ. Roy. Asiat. Soc. Straits Br. 33 (1900) 175; Becc. in Rec. Bot. Surv. Ind. II (1902) 214; Ridl., Mat. Fl. Malayan Pen. II (1907) 208; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 450 t. 203 et Suppl. (1913) 112 t. 63; Ridl., Fl. Malay Pen. V (1925) 62 pro parte = **(var. Oxleyanus)**.

C. diffusus Becc. in Hook., f., Fl. Brit. Ind. VI (1892) 447 as to the male spadix only, and in Rec. Bot. Surv. Ind. II (1902) 206; Ridl., Mat. Fl. Malayan Pen. II (1907) 209 pro parte; Furtado in Gard. Bull. Straits Settl. VIII (1935) 248 (as to the female spadix only; the leaf = *C. Diepenhorstii* var. *singaporensis*).

C. Fernandezii H. Wendl. in Kerch., Les Palm. (1878) 236.

Daemonorops fasciculatus Mart., Hist. Nat. Palm III (1850) 330; Miq., Fl. Ind. Bot. III (1856) 101.

Rotan Pajare Griff. in Calc. Journ. V (1845) 89 et Palms Brit. Ind. (1850) sub *C. angustifolius* Obs. p. 95.

Stem scandent or semi-scandent, with sheaths 2–3·5 cm. in diam., 4–6 m. long. *Leaf-sheaths* straw-coloured, non-flagelliferous, slightly gibbous above, very obliquely truncate, densely armed all over with unequal reflexed, blackish or schistaceous, spines, the smallest variable in size up to 5 mm. long, the medium 2–3 cm. long, and the largest up to 6 cm. long; along the margins of the mouth with slender, brittle, 2–4 cm. long spines. *Ocrea* bordering on the mouth of the sheath brittle, deciduous, armed with narrow, unequal, black, ascendent or reflexed spines. *Leaves* about 1·5–2·5 m. long, excluding the long cirrus; petiole 30–60 cm. long, porrect, armed along the margins with more than one row of shorter spines, the dorsum in the basal part being unarmed, polished, yellow, and marbled nearly as far down as the geniculum but armed with solitary distant, brown-tipped claws in the upper half; rachis armed along the margins with one or two series of spines on each side and with solitary claws along the middle, the marginal spines becoming fewer and the claws digitate in the distal portions. *Leaflets* numerous, fascicled, all in one plane (each fascicle of 4–10 leaflets, equidistant, 15–20 mm. apart in each fascile, the groups being 15–25 cm. apart), papyraceous, green on both sides, glabrous, 3–5 costate, with a few bristles in the 3 middle costae above, occasionally also in the other two; all nerves naked beneath; margins spinulous. *Female spadix* about 1 m. long, clawed on the axis, divided into 5–7 branches, not flagelliform, ending in a small filiform, clawed appendix; primary spathes tubular, 6–12 cm. long, unarmed or very sparingly prickly, ending in a narrow auriculiform, acuminate apex; the basal spathe bicarinate, others with only one ridge. *Primary branches* spreading, inserted at the mouth of the axillant spathes, about 20–50 cm. long, with 4–8 spikelets on each side; secondary spathes 1·5–2·5 cm. long, tubular, unarmed, finely striate, acute at apex. *Spikelets* vermicular, the largest 15–20 cm. long, with 18–22 flowers on each side, gradually shorter in upper parts and with fewer flowers; spathels tubular, glabrous, striate, with a deflexed apex. *Involucrophore* very shallow, orbicular, exsert; involucre circular, saucer-shaped. *Female flowers* 4 mm. long, nearly 1 cm. apart; calyx deeply lobed, slightly shorter than the corolla. *Fruiting perianth* shortly pedicelliform with a callous base. *Fruit* nearly globular, 10–12 mm. long, 8–10 in diam., mucronate; scales in 12–13 longitudinal series, straw-coloured, with red brown margins; seed globular, much wrinkled; albumen homogeneous with a few superficial ruminations; embryo basal. *Male spadix* similar but slender; the spikelets 4–6 cm. long, in the secondary branches usually shorter.

MALAYA: Singapore, Bukit Timah (Ridley 11,473 male and female; 11,619; Sinclair 39,991; Holttum and Furtado 19,786); Toas (Ridley 6,283); Botanic Gardens (Ridley 11,338 & 10,816). **Johore,** Gunong Pulai (Mat sub Ridley n. 3,719); Batu Pahat (Ridley 11,215 as to the spadix only; leaves = *C. Diepenhorstii* var. *singaporensis*); **Malacca,** loc. incert. (Griffith in Herb. Kew and Brit. Mus.).

DISTRIBUTION: Island of Bangka (type locality).

Though this appears to have been collected very early in the Peninsula, it remained for a long time unnamed. It is not a very long rottan, and restricted usually to secondary growth. The petiole makes an acute angle with the stem, a reason why the gibbosity is not well marked and the mouth of the sheaths resemble that of the non-climbing species, being long and oblique.

Griffith named the species as *Rotan Pajare*, while Ridley stated that *Rotan Pujare* was the name on the ticket of the specimen in the British Museum. Martius recorded as *Pusare* as an alternative to *Pajare*. As *Pajare*, *Pujare* and *Pusare* are not Malay words, I quote here the following notes made after comparing the Kew specimens in 1934:—

The name on the Kew specimens is entered as *Rotang Pussare* or *Calamus Pussare*, the first *s* in *Pussare* being long resembling the manuscript *ſ* or *j*, an old practice of writing the letter *s* that precedes another *s*. The word *Pajare* must have been therefore a result of mistaking *u* for *a* and the double *ss* for *j*. Further, I think the *u* should be read as in *but*, and *are* as in *fare*, so that the name should be read as *Rotan Passer*. Thus pronounced the name may stand either for *Rotan Pasir*, meaning *"sand loving rotan"*, *"sandy rotan"* or *"a rotan whose markings suggest its being sandy"* or for *Rotan Pasiare* meaning *"Walking Stick"* from *Pasiare* or *Passear* in Portuguese meaning *"to go for a walk."* The word *Passear* was apparently used in Malacca Malay and is mentioned in Wilkinson's Malay Dictionary.

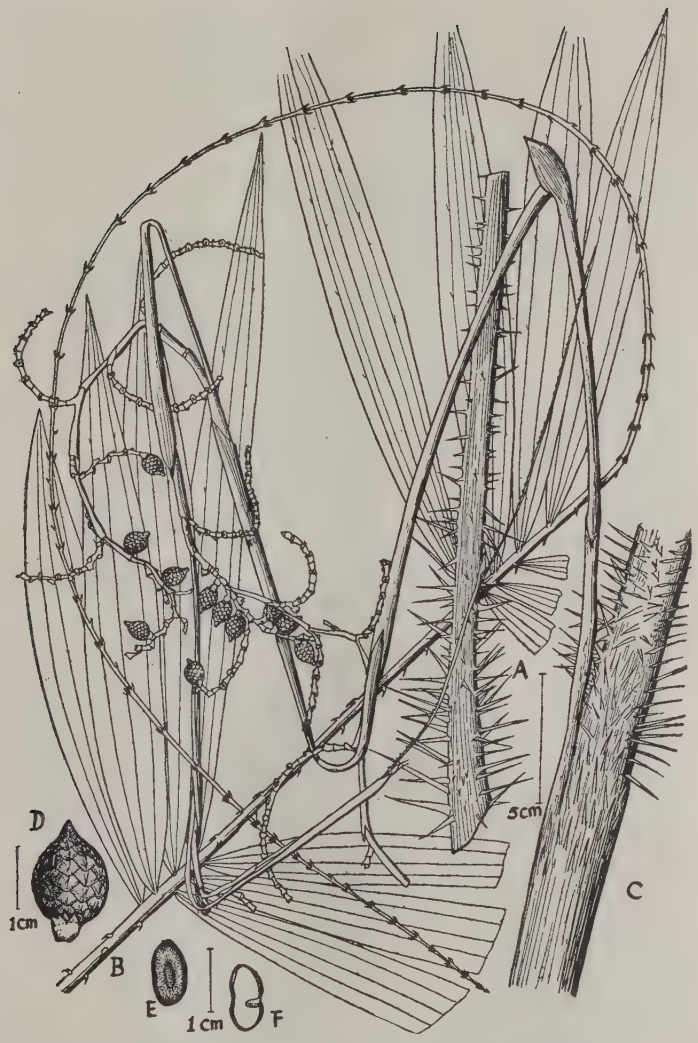
More than one specimen in the Singapore herbarium collections has a spadix of this species mixed with the leaves of another, and Ridley 11,215 is such a mixture. After a careful comparison I find that the spadix in Ridley 11,215 is not flagelliform and corresponds exactly with *C. Oxleyanus*. But the leaf, which has a gibbous petiole and no cirrus, could not belong to this species; it agrees very well with those of *C. Diepenhorstii* var *singaporensis*. I have not had an access to Lobb's specimen to determine the identity of the leaf described under *C. diffusus*, but from the description it may also be of *C. Diepenhorstii* or of its variety. (Its male spadix has been identified by Beccari as *C. Oxleyanus*).

(a) Calamus Oxleyanus Miq. var **montanus** Furtado **var. nov.—t. 13.**

Ab alteris hujus speciei taxis haec varietas foliolis in pagina superiore secus nervos duos parce setosis, fructibus ovoideis vel oblongis, squamis atro-brunneis postice flavo suffusis, secus margines atriore lineatis sat distincta.

Leaflets 3-nerved, sparingly setose above in the upper parts of the two lateral nerves, smooth beneath, deciduously setulose or smooth along the margins, bristly at tips, longest about 30–38 cm. long and 3 cm. broad. *Spadix* about 150 cm. long, unarmed except in the apical parts, 4 branched. *Fruit* ovoid or shortly oblong, 13–14 mm. long (slightly longer with the beak), 7–8 mm. in diam.; scales arranged in 12 vertical series, dark brown suffused with yellow at the base, darker along the margins.

MALAYA: Trengganu, Gunong Padang, ± 1200 m. alt. (Kiah & Moysey 31,891).



Tab. 13. *Calamus Oxleyanus* var. *montanus (Kiah & Moysey: 31,891—holotypus).*

A, Petioli pars ut armatura ejusdem et forma appareant. B, Frondis fragmentum apicale. C, Caudicis fragmentum cum spadice fructiferenti. D, Fructus. E, Semen. F, Idem verticaliter discissum ut embryonis dispositio appareat.

The portion of a leaf collected on the same mountain (Gunong Padang) by Hislop in July 1952 belongs apparently to this variety. The leaf is cirriferous and has grouped leaflets which agree well with the type of this variety. However this specimen consists of only a terminal portion of a leaf without its petiole and leaf-sheath.

(b) Calamus Oxleyanus Miq. var. **obovatus** Becc. in Ann. Roy. Bot. Gard. Calc. XI Suppl. (1913) 112 t. 63.

Differs from the type in being much more robust in all its parts and in having larger, obovate fruits about 18 mm. long, including the beak and the perianth, and 11–12 mm. through. The field notes on the sheets cited below are to the effect that the inflorescence is nearly 2 metres long and the leaf with its armed tip measures 3 m. or over in length.

MALAYA: Johore, Kluang at 10th mile Batu Pahat Road (Holttum, 9,488).

DISTRIBUTION: Bangka (Type locality).

This is the first record for the variety in Malaya.

14. Calamus simplex Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 456, Rec. Bot. Surv. Ind. II (1902) 211, et in Ann. Roy. Bot. Gard. Calc. XI (1908) 428 pl. 190.—**t. 14.**

Stem slender, scandent, with sheaths 1–2 cm. through. *Leaf-sheaths* non-flagelliferous, gibbous, strongly armed with unequal, elastic, horizontal or slightly deflexed, up to 2 cm. long spines. *Leaves* 100–150 cm. long in the pinniferous part, terminating in a long cirrus; petiole 15–20 cm. long, armed on the acute margins with a few strong horizontal spines; rachis armed along the sides beneath with a few solitary claws, digitate in the upper part of the rachis. *Leaflets* few, about 5 on each side, papyraceous, inequidistant, up to 30 cm. apart, solitary, alternate or sub-opposite, lanceolate or elliptic-lanceolate, acute at the base, shortly acuminate at the apex, 5–6 or more costate, smooth on both surfaces as also along the margins, sometimes provided with one or more polished lines near the lower margins of the basal leaflets; the largest up to 60 cm. long, 10 cm. wide, in less vigorous specimens about 30 cm. long, 5–6·5 cm. wide, the lower ones usually the largest. *Female spadix* much shorter than the leaves, 40–50 cm. long, more or less covered with a rusty-furfuraceous indumentum, erect, quite unarmed or nearly so, terminating in a small, flattened, tail-like, smooth or sharpingly spinulous appendix, divided into 2–3 spikelets on each side. *Primary spathes* 4–6 cm. long in the sheathing part, suddenly narrowed at the base into a flattened and unarmed axial portion; the basal spathes two edged, the edges smooth or sparingly spinulous. *Spikelets* inserted at the mouth of the axillant primary spathe, arched, the lowest 6–7 cm. long with 5–6 flowers on each side, others smaller; spathels infundibuliform, truncate, acute at one side. *Involucrophore* very short, subcupular; involucre cupular, almost entire. *Fruiting perianth* pedicelliform, rather thick; calyx callous at the base, divided to about midway down into three large, ovate lobes; corolla as long as the calyx. *Fruit* large, about 3 cm. long, 2 cm. broad, globose-ovoid, with a short mucro at the apex, and a short caudiculum at the base; scales in 24 series, yellowish-brown near their base, darkening towards the point with an almost black marginal line; seed globular, about 15 mm. in diam., with albumen deeply ruminate and embryo almost basal.

Tab. 14. *Calamus simplex? (Wyatt-Smith 66,590).*
A, Caudicis fragmentum sterilis. B, Pars folii.

Male spadix similar, but longer, 85 cm. long, with 4–5 alternate spikelets on each side, and the lowest spikelet having a small secondary spikelet at its base. *Primary spathes* armed with a few scattered prickles, but not armed in the axial part. *Spikelets* arched, flexuous, 12–13 cm. long, with 15–16 remote, bifarious flowers on each side; spathels funnel-shaped, sprinkled with brown scales.

MALAYA: Perak, Gunong Tambang Batak, alt. 1,900 M. (Scortechini, 432b in herb. Becc.).

This very distinct species, which is easily recognised by its simple spadices having spikelets borne directly on the main axis, is known only from the type collections taken from male and female plants. Beccari has an excellent plate to illustrate the species. For unaccountable reasons Ridley ignored this species altogether in both his floristic works (1907 & 1925). Sterile specimens collected by Wyatt-Smith (No. 66,590) and Henderson (18,021), both on Cameron Highlands, Pahang, approach very near to *C. simplex* but in the absence of flowering or fruiting material it is not easy to determine the specimens accurately.

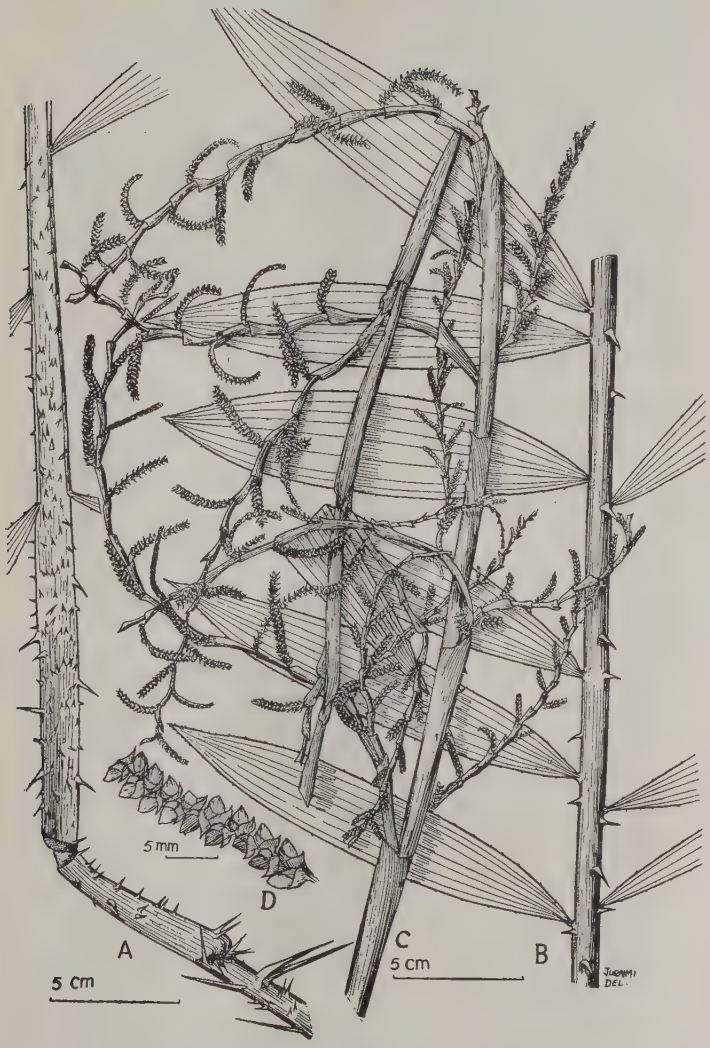
15. Calamus palustris Griff. var. **malaccensis** Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 405 et Suppl. (1913) 86.—**t. 15.**

C. dumetorum Ridl., Mat. Fl. Malayan Pen. II (1907) 211 et Fl. Malay Pen. V (1925) 63.

C. palustris Griff. *sensu* Ridl., Fl. Malayan Pen. II (1907) 206 et Fl. Malay Pen. V (1925) 61 pro parte.

Stem scandent, 6 m. long, 2·5–3 cm. in diam. *Leaf-sheaths* gibbous, armed with numerous very unequal, laminar, 1 cm. to 3 cm. long, more or less ascendent or horizontal spines, the larger ones absent in the geniculum. *Ocrea* not seen. *Leaves* cirriferous, long; petiole in Ridley's specimen cited below, about 12 cm. long, the basal part of the rachis densely armed above with short erect, sharp-pointed, subequal spines, but armature considerably less below; the mesial parts of the rachis armed above with a few small prickles, and below with 1 cm. long spines distantly placed along the margins and the median terminal parts not seen. *Leaflets* solitary or in pairs or ternate on each side of rachis, subopposite, 5–7 costate, slightly plicate, lanceolate, narrowed on both sides, naked on both surfaces or spinulose on the midcosta above, distinctly and closely spinulose on the margins and bristly on the apex; the largest 30–33 cm. long and 3–4 cm. broad. *Male spadix* shorter than the leaves, non-flagelliform, 60–100 cm. long, terminating in a short spadix; primary spathes loose, chartaceous, ligulate, sparsely aculeate on one side only, 7–12 cm. long. *Primary branches* 15–30 cm. long, sometimes bearing secondary branches or spikelets; secondary spathes loose, smooth, 1–1·5 cm. long; secondary branches 10–15 cm. long; tertiary spathes similar, but smaller. *Spikelets* 2–4 cm. long; spathels bracteiform, concave, one-sided, apiculate, striate; involucre cupular. *Male flowers* all immature, still enclosed in the calyx, 2–3 mm. long.

MALAYA: Perak, loc. incert. (Scortechini, 50b); Lahat near Ipoh in open country (Ridley, 11,988).



Tab. 15. *Calamus palustris* var. *malaccensis (Ridley 11,988).*
A. Petiolus. B, Folii pars. C, Spadix sine parte basali. D, Spicula ejusdem ampliata.

Beccari, who compared the type of *C. dumetorum* (Ridley, 11,988) with the type of this variety (Scortechini 50b), found no material difference between these two specimens. I have not seen Scortechini's specimen, and so have followed Beccari's disposition. Ridley has not recognised this variety nor has he accepted Beccari's reduction of *C. dumetorum*.

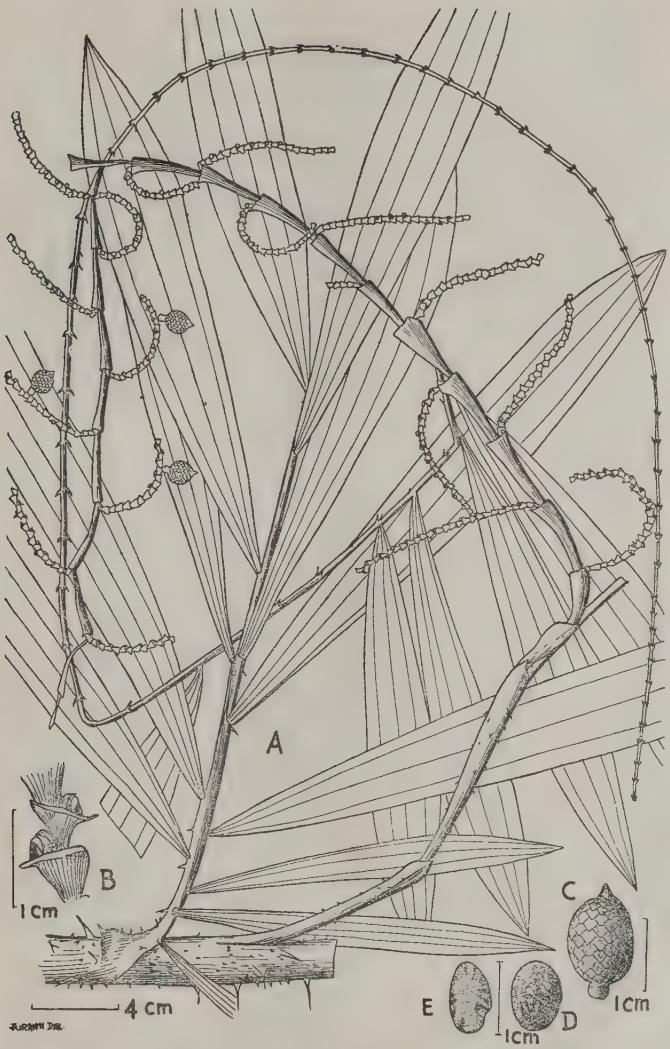
The type form of the species came from Tenasserim in Burma and has not been found in Malaya. Ridley was apparently confused as to the length of the petiole, because the lower leaflets have been partly removed in the type of *C. dumetorum* and so he stated that the petiole was over 30 cm. long. In the young stages of plants of this type, the petioles are longer but gradually they become shorter and finally obsolete.

I have not seen Alvins' collection from Bukit Sulu, Negri Sembilan, cited by Ridley under *C. palustris*.

16. Calamus caesius Bl., Rumphia III (1849) 57; Mart. Hist. Nat. Palm. III (1850) 340; Miq., Fl. Ind. Bat. III (1856) 129; Becc. in Hook., f., Fl. Brit. Ind. VI (1893) 456 et in Rec. Bot. Surv. Ind. II (1902) 211; Ridl., Mat. Fl. Malayan Pen. II (1907) 205; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 426 tt. 188A et 189, et Suppl. (1913) 105; Ridl., in Journ. Roy. Asiat. Soc. Straits Br. 68 (1915) 14 et Fl. Malay Pen. V (1925) 60.—**t. 16.**

C. glaucescens Bl. Rumphia III (1849) 65, et al.

Stem tufted, scandent, slender, 15–20 m. long, with sheaths 13–20 mm. in diam., non-flagelliferous. *Leaf-sheaths* gibbous above, covered with deciduous furfur, when young splashed white, brown later, striate, armed with unequal, horizontal or reflexed, scattered, solitary, 1–2 cm. long broad-based spines, intermingled with very minute tuberculiform, sharp or obtuse, ascendent spines, the latter practically absent in young plants. *Ocrea* very short. *Leaves* 60–80 cm. in the pinniferous part, terminating in a long cirrus; petiole wanting or obsolete; rachis armed with solitary claws along the margins and the middle of the dorsum, becoming digitate and half-whorled in the distal half and on the cirrus. *Leaflets* 16–25 in all, 7–13 on each side, irregularly set, usually in pairs, but often three on one side at the base, and a solitary leaflet at the apex on the base of the cirrus, and occasionally also a solitary leaflet in the middle (the pairs subopposite or alternate), glaucous beneath, 4–6 costate, obovate or oblong-elliptic, gradually cuneate towards the base, unarmed on both surfaces, spinulose in the margins and at apex; sometimes one or more shining lines along the lower margin; the mesial leaflets largest, 25–30 cm. long, 4·5–5·5 cm. wide; the narrowest at the base. *Female spadix* 90–150 cm. long, deciduously brown furfuraceous, not flagelliform, divided in 5–6 branches, terminating in a short, weak up to 30 cm. long appendix armed with claw-like simple spines. *Primary spathes* 7–20 cm. long, tubular, obliquely truncate, acuminate, the basal one bicarinate, unarmed or armed with a few, small prickles; the second spathe above the first, unicarinate, more armed than the one at the base, others cylindrical and more armed. *Primary branches* 50–75 cm. long, with 6–10 spikelets on each



Tab. 16. *Calamus caesius (Furtado 30,923).*

A, Caudicis pars cum folio et spadice. B, Spiculae pars ut spathella, involucrophorum et involucrum appareant. C, Fructus cum perianthio. D, Semen. E, Idem verticaliter discissum.

side; secondary spathes 2·5–4·5 cm. long, obliquely truncate, shortly apiculate, usually unarmed, but occasionally slightly armed. *Spikelets* slightly outside the axillant spathe, reflexed, 6–12 cm. long with 9–16 flowers on each side; spathels funnel-shaped, truncate, fugaciously brown-furfuraceous. *Involcrophore* slightly exsert, cupular; involucre similar. *Fruiting perianth* pedicelliform, shortly lobed, calyx as long as the corolla. *Fruit* ellipsoid, 18–22 mm. long including beak and the cyathiform perianth, 10–13 mm. broad; scales concolorous, yellow, disposed in 16–21 series; seed with deeply ruminate albumen and supra-basal embryo. *Male spadix* more slender, up to 2·5 m. long, but often shorter. *Spikelets* on primary branches none or few, up to 2 cm. long, usually on secondary branches and then up to 1–1·5 cm. long with 4–6 closely packed male flowers on each side with an odd flower at the apex. *Secondary spathes* armed or not; tertiary spathes 3–4 mm. long, funnel-shaped, long, apiculate. *Male flowers* 3–4 mm. long, oblong, yellowish; corolla nearly twice as long as the calyx.

MALAYA: loc. incert., cult. in Hort. Bot. Bogor. X.E. 8 (Furtado 30,922). **Perak,** loc. incert. (Scortechini 456). **Johore,** Batu Pahat (Ridley 11,382, as *Rotan Segar*; Machado sub Ridley's no. 11,382, as *Rotan Segar*); Muar (Pears sub Ridley's no. 10,716 as *Rotan Segah*).

SUMATRA: loc. incert., cult. in Hort. Bot. Sing. (Burkill 592); cult. in Hort. Bot. Bogor. X.E. 11. a. (Furtado 30,923).

BORNEO: Sandakan, Sapagaya (Clemente and Puasa 4,942 as *Rotan Sega*).

JAVA: loc. incert. cult. in Hort. Bot. Bogor. XII.C. 96. a. (Furtado 30,801).

As this species has been widely spread through cultivation by the jungle tribes, it is doubtful whether any of the above given records is from wild plants. The species was established on a sterile specimen from Borneo, and, despite its wide distribution in Malaya, Sumatra, Borneo and Java and its use in wicker work, its identity had for a long time remained obscure. Fortunately Beccari was able to gain access to the original fragmentary material and to work out its specific identity by comparing it with Scortechini's collection from the Malay Peninsula. The species shows some variations, perhaps as a result of wide and long cultivation.

Since the plant is tufted, it can be harvested periodically for its canes. It appears that the species may be propagated by suckers. Scortechini's specimen cited above is known to me only through Beccari's plate which agrees very well with the leaf in Pears 10,716 (Muar) which is accompanied by fruits.

17. Calamus pallidulus Becc. in Hook., fl., Fl., Brit. Ind. VI (1893) 457, and in Ann. Roy. Bot. Gard. Calc. XI (1908) 447 t. 200; Ridl., in Journ. (1907) 209; Becc. in Ann. Roy. Bot. Gard. Calc. XI Appendix (1913) 109; Ridl., Flor. Mal. Pen. V (1925) 62; (Sphalmate *C. pallidus*).—**t. 17.**

C. Diepenhorstii Miq. *sensu* Ridl., Flor. cit. V (1925) 55 pro parte.

Tab. 17. *Calamus pallidulus (Ridley 6,281).*
Caudicis fragmentum ut vaginae, folium, spadix fructiferens appareant.

C. longispathus (longispatha) Ridl., Mat. Fl. Malayan Pen. II (1907) 209 pro parte (ex altera parte = *C. longispathus* Ridl., *emend* Becc., et *C. peregrinus*).

C. singaporensis Becc. *sensu* Ridl., Mat. cit. II (1907) 199 pro parte.

Stems slender, solitary, about 2 cm. in diam., 6–10 m. long. *Leaf-sheaths* straw-coloured, gibbose above, armed with short reflexed, subequal spines placed on swollen bases, sometimes the swollen warts not provided with prickles. *Leaves* sessile, with 13–18 leaflets on each side; the latter very closely set in the lower half, reflexed, the basal ones amplexicaul, in the upper half inequidistant or even obscurely fasciculate (the juvenile leaves petiolate or not, and often conspicuously fasciculate in the upper parts); rachis unarmed above, but with many solitary or digitate black-tipped claws beneath. *Leaflets* 1–3 nerved, ensiform, or elliptic ensiform, slightly plicate, usually smooth on both surfaces, rarely provided with a few setae on the margins and tips, and very rarely also in the midnerve beneath, abruptly narrowed at the apex; the largest mesial 15–18 cm. long, 2–2·5 cm. wide, or slightly larger. *Female spadix* somewhat erect, bearing simple or compound branches. *Primary spathes* and others armed or scabrid, ciliate, paleaceous at the margin of the mouth, sometimes deciduously pubescent. *Spikelets* patent, borne on primary or secondary branches; spathels scabrid, ciliate at the mouth. *Involucrophore* exsert, not deep; involucre shallow. *Fruiting perianth* pedicelliform. *Fruit* sphaeric, 18 mm. in diam. acute at both ends; scales straw-coloured, brownish along the margins, arranged in 15–19 vertical series; seed deeply ruminate. *Male spadix* apparently decompound, deciduously furfuraceous. *Spathes* primary and others deciduously puberulous, less spiny and scabrid than the female ones. *Spathels* concave, bracteiform, long-apexed, scabrid, deciduously puberulous. *Involucre* semi-cupular, truncate nearly to the base on the anticous side, extended on the side next to the axis into a long, erect, two keeled, wing. *Male flowers* not known.

MALAYA: Kemaman, Bukit Kajang (Corner 30,561, juvenile, vern. nom. *Rotan Ria*). **Kedah,** Sungei Labon, Baling (Furtado 33,059, juvenile); Bukit Seblak, Weng (Furtado 33,067, juvenile). **Perak,** Taiping (Wray 2,392, syntype); Simpang (Wray 3,017, syntype). **Selangor,** Bukit Enggang, Kajang (Symington 24,206, vern. nom. *Rotan Tunggal*). **Negri Sembilan,** Senawang (Holttum 9,944, vern. nom. *Rotan Tunggal*); Sungei Ujong (Alvins s.n.). **Singapore,** Jalan Bray (Ridley 6,281); Bukit Timah (Goodenough in 1892; Ridley in 1907, juvenile); Bukit Mandai (Ridley in 1907, juvenile).

The species produces long petioled leaves when young, but the petiole gradually decreases in size as the plant gets older, and in climbing plants the leaf-sheaths are gibbose at the apex. There may be seen other variations too. Thus the leaf-sheaths in Corner 30,561 (Kemaman) bear no spines and the leaves are much longer than in the type; further the leaf-sheaths, leaf-rachis, and leaflets are greenish when dry. Furtado 33,059 and 33,067 (Kedah) which have yellowish sheaths, leaf-rachis, and leaflets, have shorter leaves, and the sheaths are with or sometimes without spines. Holttum 9,944 (Negri Sembilan) bears fruiting spikelets on the secondary branches, the spikelets being about 2–4 cm. long, so that they look very much like those in the male spadix;

its primary and other spathes are also very much woody. Symington 24,206 (Selangor) has a weak female spadix, and the spathes are less woody, but, as in the type, the spikelets are 5–8 cm. long borne on the primary branches. The male specimen (Alvins from Negri Sembilan) is old, showing slight traces of decomposition, and so the spathes may have lost their paleae and spines; the lower part of the spadix is also wanting.

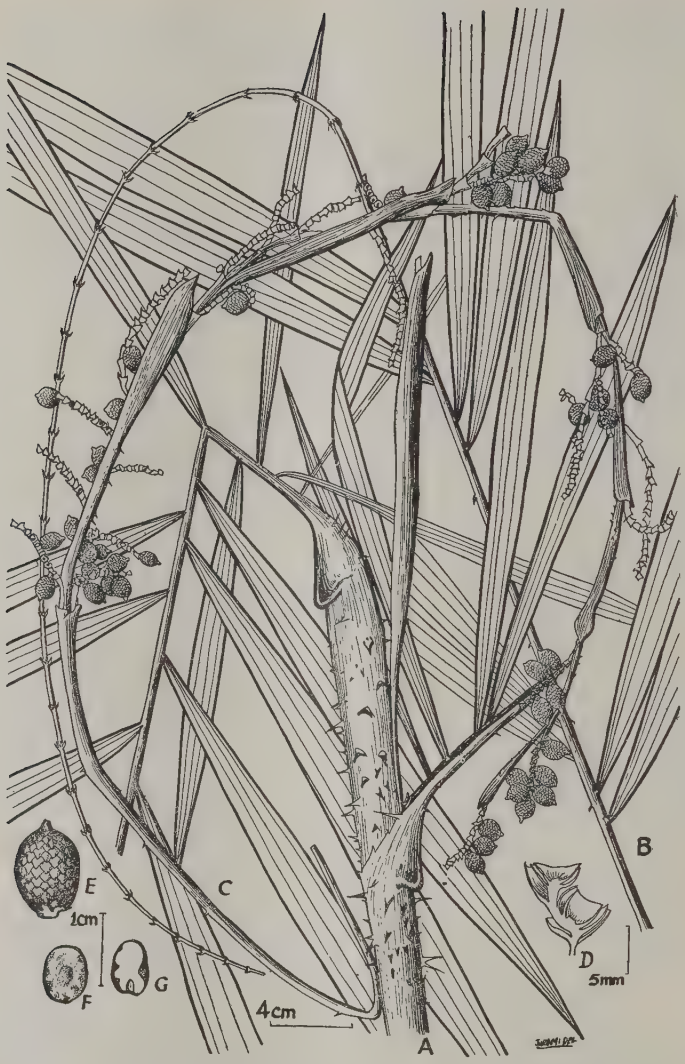
The syntype Wray 3,017 has fewer leaflets and Beccari states that they are 4–5 on each side. But both the Singapore herbarium duplicates and Beccari's plate show marks that the leaflets have been torn off; the only distinction that one notices in the syntypes is that some of the leaflets are larger and broader, and the leaf-sheath and the leaf-rachis are more densely armed. The fruit scales in the syntypes are 15–16, while in Holttum 9,944 and Symington the scales are 18–19 series.

Both the syntypes were transferred by Ridley to his *C. longispathus*, while *C. pallidulus* was reserved for a new specimen from Singapore (Ridley 6,281). Later Ridley included these two syntypes under *C. pallidulus*, but without realizing that these were the specimens he had cited previously under *C. longispathus*. Hence in 1925 he made under the latter species the following remarks: "I think it better to exclude the Perak plants I added formerly to this species until I can examine them again."

This species has been very much confused as the distribution of the following specimens shows: Bukit Mandai (Singapore leg. Ridley) under *C. penicillatus*; Bukit Timah (Singapore leg. Ridley) under *C. Diepenhorstii* (= *C. singaporensis*); and Sungei Ujong (leg. Alvins) under *Plectocomiopsis Scortechinii*. The species seems to be widely distributed in Malaya; but being slender its stems are probably useful as a cane, and, being solitary, it runs the risk of extermination since it would be cut when it just begins to flower. Probably its value as a cane is also the reason why the species is rarely found in flower or fruit.

18. Calamus axillaris Becc. in Hook. f., Fl., Brit. Ind. VI (1893) 456, in Rec. Bot. Surv. Ind. II (1902) 211 et in Ann. Roy. Bot. Gard. Calc. XI (1908) 414 t. 181.—**t. 18.**

Stems scandent, 2 cm. in diam. *Leaf-sheaths* gibbose at the apex, irregularly armed with horizontal or slightly reflexed, unequal, rigid spines up to 10 mm. long, which are swollen at base above, concave below, often slightly obliquely placed. *Leaves* about 1 m. long in the pinniferous part; petiole obsolete or up to about 4 cm. long; rachis unarmed above, channelled in the lower portion, provided or not with a few short, distant spines along the margins towards the base and with a few obscure minute prickles below the petiole, armed upwards in the lower surface with simple or digitate claws. *Leaflets* about 18 on each side, unequal, inequidistant, alternate but not distinctly fascicled



Tab. 18. *Calamus axillaris (Furtado 33,030a).*

A, Caudicis fragmentum ut vaginae, petioli obsoleti, et spadicis dispositio appareant. B, Frondis fragmentum apicale. C, Spadix fructiferens. D, Spiculae pars verticaliter discissa ut dispositio spathellae, involucrophori et involucri appareat. E, Fructus cum perianthio. F, Semen. G, Idem verticaliter discissum.

in the lower half, often in distant geminate fascicles on each side towards the summit, lanceolate or nearly ensiform, 3–5 costate, unarmed in the female, indistinctly spinulose along the margins in the male (Beccari); the largest mesial, 32–38 cm. long, 2–3·5 cm. wide. *Male spadix* apparently axillary, in one specimen 1·4 m. long, terminating in a spikelet, not in an appendix, divided into 6 large branches, excluding the terminal ones each of which is a spikelet. *Primary spathes* fugaciously furfuraceous, striate, the lower ones flattened, others cylindric, unarmed or with a prickle near the summit in the upper spathes. *Primary branches* 12–20 cm. apart, the lower ones 20–25 cm. long, upper ones smaller, attached at the mouth of their own spathes; secondary spathes long-funnel-shaped, loosely sheathing in their upper part, deciduously furfuraceous, ciliate at the mouth. *Spikelets* 2–2·5 cm. long; arched, with 6–12 flowers on each side; spathels short, bracteiform, striate, concave, ciliate at the margin. *Involucre* half-cupular, bidentate; male flowers immature. *Female spadix* arising 8 cm. above the axil of the leaf, 1 m. long, ending in a spikelet, divided into 5 spikelet-bearing branches, the other 3 terminal branches being each a solitary spikelet. *Primary spathes* tubular, slightly split on one side, sparsely prickly; secondary spathes tubular, unarmed, usually carinate on one side. *Spikelets* 3–5 cm. long; spathels broadly funnel-shaped, obliquely truncate, deciduously furfuraceous. *Involucrophore* cupular, almost entirely included in the spathel: involucre similarly shaped, often two or three angled. *Fruiting perianth* deeply divided with a shallow companulate undivided base corresponding to the portion included in the involucre. *Fruit* oblong, shortly beaked, about 10 mm. long, 8 mm. in diam.; scales straw-coloured with lighter marginal lines, sometimes brownish tinged at the tips and in some parts of the margins, arranged in 23 series; seed 7 mm. long, 5 mm. wide, convex and pitted on one side, flattened on the side of the chalazal fovea; albumen equable; embryo basal.

MALAYA: Perak, loc. incert. (Scortechini, male type); Kroh (Furtado 33,030[a], female).

So far this species was known only from the male type collection, and despite Beccari's excellent plate of the type, Ridley has persistently ignored it. The female specimen is described for the first time here. As in the male, the female leaf examined has also 18 leaflets on each side; and unlike *C. Hendersonii* which has distant fascicled leaflets even in the lower half of the leaves, *C. axillaris* tend to produce grouped (geminate) leaflets only in the distant end of the leaf.

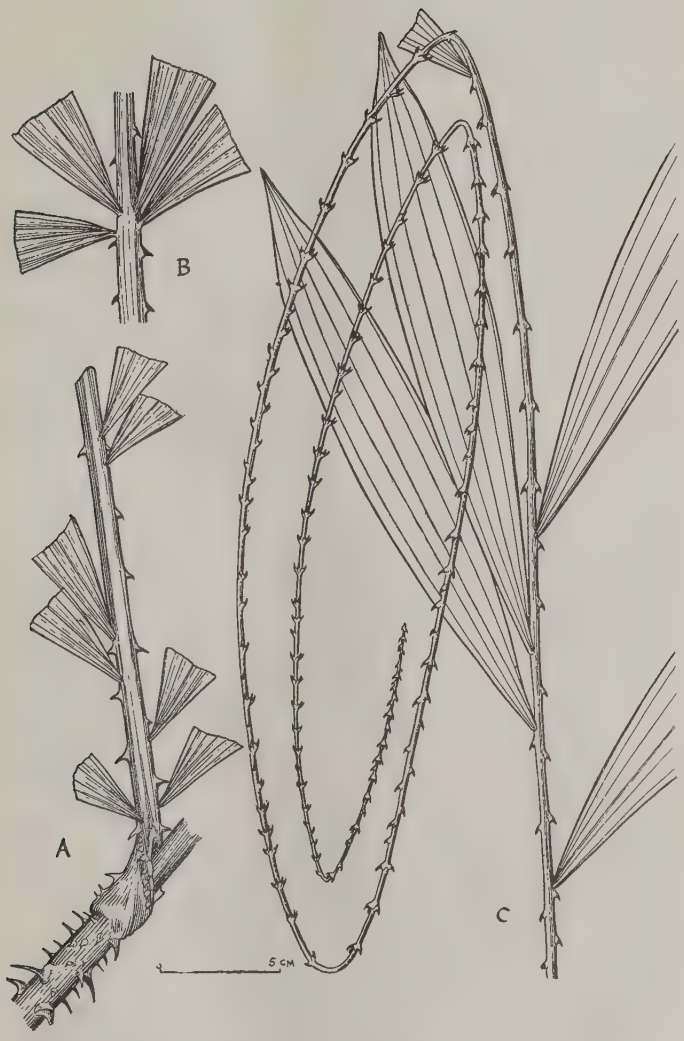
C. axillaris, *C. Hendersonii* and *C. riparius* seem to form a group of closely allied species and it is necessary to study variations within each to see whether any of these is merely a form of the other. Both *C. Hendersonii* and *C. riparius* do not produce, in the specimens seen, simple spikelets as primary branches in the terminal portions of the spadix; whereas in *C. axillaris* such simple spikelets seem to be common in the apical portions of both male and female spadices (see also remarks under *C. riparius* and *C. Hendersonii*).

19. Calamus Hendersonii Furtado **spec. nov.—t.t. 19 & 19a.**

Inter species ad Sectionem Phyllanthecti pertinentes ponenda, sed differt: petiolis obsoletis; foliolis obovato-ellipticis etiam petioli basin versus fasciculatis, per fasciculos binis, haud glaucescentibus; inflorescentiis partialibus multas spiculas ferentibus; spathis laxiusculis. Aspectu generali C. caesio *et* C. axillari *simillima, sed a priore petiolis obsoletis, foliolis in pagina inferiore haud glaucescentibus, perianthiis fructiferis ad basin fere fissis (haud pedicelliformibus) et a* C. axillari *foliolis etiam petioli basin versus conspicue fasciculatis, dissimilima.*

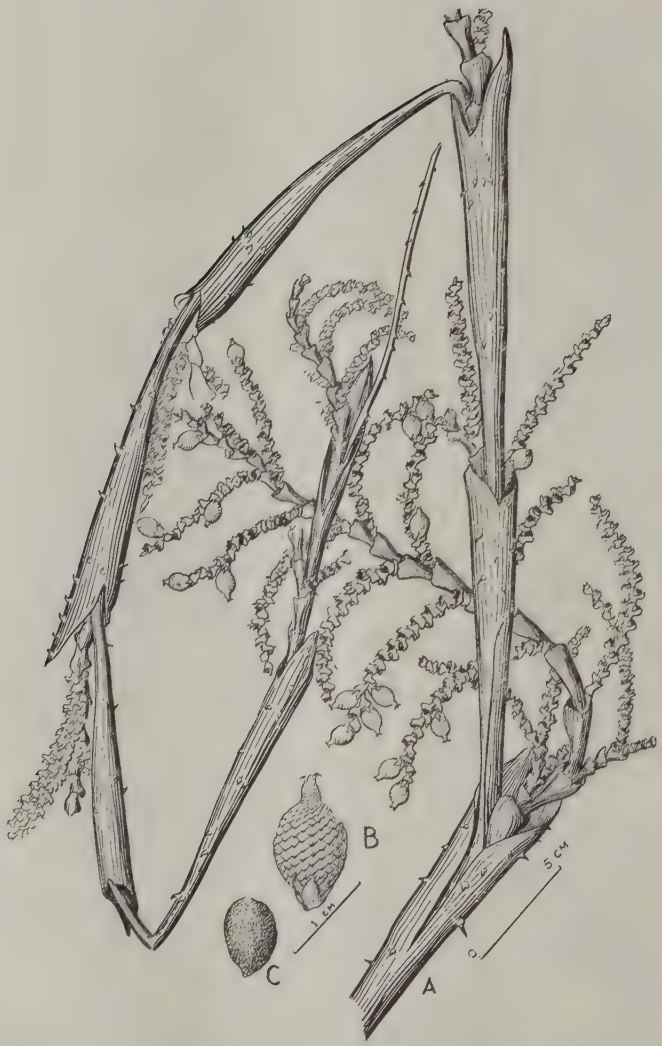
Caudex scandens, cum vaginis circa 2–2·5 cm. crassus. *Vagina* frondium haud flagellifera, spinis dimensione variabilibus, maximis ad 1·5 cm. longis, basi superne nonnihil tumescentibus, inferne concaviusculis, apicem versus arcuatim attentuatis, horizontaliter vel interdum oblique sitis, reflexis vel ascendentibus, minimis conformibus 3–4 mm. longis vel verruculosis armata, lutea fugaceo furfuracea, apicem versus gibbosa. *Ocrea* brevis, marcescens, decidua. *Frons* sessilis vel obsoleto petiolata, ultra metralis ut videtur; in cirrum longum terminans; rachis dorso unguibus basin versus solitariis per series 3 irregulares dispositis, apicem versus digitatis armata. *Foliola* lutea, subconcoloria, conspicue geminata, alterna vel rarissime opposita, obovato-elliptica, porrecta, 4–6 nervosa, untrinque inermia, secus margines obscure spinulosa, apice obscure setosa vel inermia, subaequalia, 25–30 cm. longa, 4–5 cm. lata. *Spadix femineus* metralis, breviter pedunculatus, fronde minor, in appendicem circa 8 cm. longam unguiculatum terminatus, in 7–8 ramis paulo infra spatharum apicem orientibus ad 25 cm. usque longis spiculiferentibus divisus. *Spathae primariae* tubulosae nonnihil laxae, apice marcescentes, striatae, oblique truncatae, unguibus solitariis brevibus armatae, 10–15 cm. longae; spathae secundariae 1–2·5 cm. longae, inermes, truncatae, paulo ligulatae, late infundibuliformes, laxae deciduo furfuraceae. *Spiculae* 7–10 cm. longae, floribus congestis utrinsecus 8–15 distichis; spathellae late infundibuliformes, ligulatae, striatae, laxiusculae. *Involucrophorum* cupuliforme; involucrum conforme. *Perianthium fructiferum* fere ad basin divisum, explanatum; calyce corolla aequilonga. *Fructus* immaturus tantum visus, oblongus, apice rostratus; squamis flavis secus margines leviter brunnescentibus, dorso canaliculatis, per series verticales 22–26 dispositis; albumine superficialiter ruminato et profunde fossato.

Stem climbing, 2–2·5 cm. in diam., not flagelliferous. *Leaf-sheaths* gibbous, straw-coloured, deciduously furfuraceous, armed with unequal, slightly ascendent or reflexed, ·5–1·5 cm. long spines, the smaller ones sometimes reduced to mere warts. *Leaves* sessile or obsoletely petioled, apparently a metre long excluding the long cirrus at the end; rachis armed with solitary claws in the basal portions, digitate in the distal parts. *Leaflets* straw-coloured, geminate, alternate, rarely opposite, obovate-elliptic, 4–6 costate, 25–30 cm. long, 4–5 cm. broad, naked on both surfaces, obscurely spinulose along the margins, often armed at apex. *Female spadix* shorter than the leaves, non-flagelliform, divided into 7–8 branches. *Primary spathes* 10–15 cm. long, aculeate, lax, marcecent at apex. *Primary branches* up to 25 cm. long, arising a little below the mouth of the axillant spathes, rarely bearing secondary branches at the base, usually producing 6–10 spikelets on each side; secondary spathes unarmed, 1–3 cm. long, lax funnel-shaped, fugaciously furfuraceous. *Spikelets* 7–10 cm. long, with 8–15 distichous



Tab. 19. *Calamus Hendersonii (Henderson 22,119 holotypus).*

A, Caudicis fragmentum ut vagina, petiolus obsoletus, foliolorum dispositio appareant. B, Frondis fragmentum mesiale. C, Frondis fragmentum apicale.



Tab. 19 (*a*). *Calamus Hendersonii (Henderson 22,119—holotypus).*
A, Spadix fructiferens. B. Fructus cum perianthio. C, Semen.

flowers on each side; spathels ligulate, striate, lax, unarmed. *Fruiting perianth* explanate, divided almost to the base, with the calyx as long as the corolla. *Fruit* immature, oblong, rostrate; scales yellowish with brown margins, disposed in 22–26 vertical series.

MALAYA: Pahang, Sungei Pertang, prope fluminis originem Malaice Ulu Tembeling dictam (Henderson 22,119).

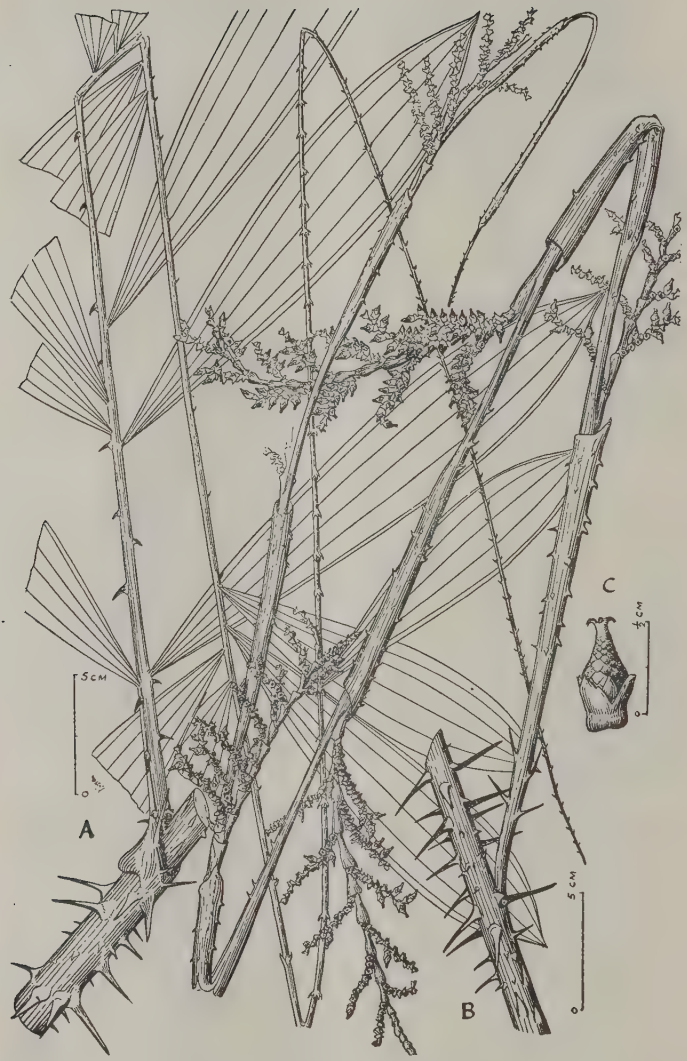
Were it not for its concolorous leaflets, non-pedicelliform, split calyx of the fruiting perianth and the somewhat loosely sheathing primary and secondary spathes, this species might have been easily confused with *C. caesius*. The last two characters also distinguish it from *C. riparius*.

C. Hendersonii is also very closely allied to *C. axillaris*, but the latter species does not have conspicuously fasciculate leaflets in the lower half of the leaves. Further in *C. Hendersonii* the calyx which, even in undeveloped fruits, has a deeply split, base at least on one side, whereas in *C. axillaris* the fruiting calyx is undivided and campanulate at the base. The seeds in *C. Hendersonii* appear to be also more ruminate.

20. Calamus riparius Furtado **spec. nov.—t. 20.**

A C. caesio *cui affinissima, aculeis vaginalibus longioribus, frondibus conspicue petiolatis, foliolis subtus haud glaucescentibus apice longe acuminatis, spadicibus erectiusculis, inflorescentibus partialibus multo brevioribus, spathis secundariis et spiculis brevioribus differt. A* C. Hendersonio, *cui aspectu generali haec species simillima aculeis vaginalibus et petiolaribus longioribus angustioribusque, frondibus conspicue petiolatis, spadicis axibus, spathis et spiculis gracilioribus, involucris pateriformibus, perianthio fructus pedicelliforme urceolato basi truncato, squamis fructus paucioribus dissimillima.*

Caudex soboliferus (?), scandens, circa 15–18 m. longus, cum vaginis 2–2·5 cm. in diam. *Vaginae* frondium deciduo furfuraceae, infra petiolum gibbosae, apice oblique truncatae, aculeis majoribus subaequalibus, 1·5–2·5 cm. longis, angustis facile fragilibus, solitariis interdum approximatis, verticaliter remotis, alteris multo minoribus paucis intermixtis armatae, verticaliter striatae, haud flagelliferae. *Ocrea* 1 cm. longa, mox marcescens decidua. *Frondes* in parte pinnifera 75–100 cm. longae, in cirrum longum terminatae; petioli 6–7 cm. longi, secus margines aculeis variabilibus, conformibus, subtus minoribus paucioribusque armati; rachis secus margines et dorsum aculeis minoribus reflexis solitariis remotis armata, in parte terminali unguibus digitatis. *Foliola* in folii rache utrinsecus 8–12, basalia angustiora, infima utrinsecus solitaria vel geminata, duo apicalia solitaria, minima, altera geminata subaequalia subopposita, obovato lanceolata, basin versus sensim cuneata, apicem versus arcuato angustata, longe acuminata, 4–6 costata, in medio secus costas duas majores laterales supra tantum paulo aculeolata vel inermia, subtus et secus margines inermia, apice deciduo setosa, interdum secus marginem inferiorem 1–2 lineis politis



Tab. 20. *Calamus riparius (Kiah 32,310—holotypus).*

A, Caudicis pars cum vagina et folio. B, Caudicis fragmentum cum spadice fructigerenti. C, Fructus immaturus.

notata (maxima 25–32 cm. longa 4·5–5·3 cm. lata), subtus pallidiuscula, geminis 10–25 cm. inter se remotis. *Spadix femineus* erectiusculus, 80–120 cm. longus, in appendicem 6–15 cm. longam, unguiculatum terminatus, in ramos 6 divisus. *Spathae primariae* 8–20 cm. longae, deciduo furfuraceae, striatae, aculeis brevis robustis reflexis armatae; spatha basalis bicarinata, secus carinas aculeis angustissimis rectis ad 2 cm. usque longis praedita; alterae spathae cylindricae. *Rami primarii* spiculiferentes pyramidales, paulo supra spatharum apicem orientes, 6–20 cm. longi; spathae secundariae 5–15 mm. longae, striatae, late infundibuliformes, apiculatae, secus margines fimbriatae. *Spiculae* 2–5 cm. longae, untrinsecus floribus 6–12; spathellae bracteiformes, concavae, apiculatae, striatae. *Involucrophorum* paulo exsertum, cupulare; involucrum pateriforme. *Perianthium fructiferum* cyathiforme basi truncatum; calyx corollae aequilongus, ad medium partitus. *Fructus* vixdum ex perianthium exsertus, minime evolutis; squamis luteis secus margines brunnescentibus, per series 15–16 dispositis ut videtur.

Stem scandent, 15–18 m. long, 2–2·5 cm. through. *Leaf-sheaths* gibbous, deciduously furfuraceous, striate, armed with unequal spines, the longer ones 1·5–2·5 cm. long, the smaller ones minute and intermingled with others. *Leaves* 75–100 cm. in the pinniferous parts, ending in a long cirrus; petiole 6–7 cm. long, sparsely armed on the margins and on the lower surface; claws on the rachis a few, solitary at first, digitate in the distal portion. *Leaflets* 8–12 on each side of the rachis, usually arranged in groups of two, though often solitary at the base, subopposite or alternate, obovate, gradually cuneate at the base, long acuminate at the apex, 4–6 costate, somewhat paler beneath, unarmed all over excepting a few spinules in the middle of the rib on each side of the main nerve and a few deciduous setae at the apex; the largest leaflets 25–32 cm. long, 4·5–5·3 cm. broad. *Female spadix* 80–120 cm. long, subdivided in 6 unequal branches, and ending in a small 6–15 cm. long, clawed appendix. *Primary spathes* 8–20 cm. long, tubular, striate, armed with short, robust claws; the basal spathe bicarinate, the spines along the carinae few and straight; secondary spathes 5–15 mm. long, striate, fimbriate at margins. *Spikelets* 2–5 cm. long with 6–12 distichous flowers on each side. *Fruiting perianth* pedicelliform. *Fruit* quite immature, scales appearing to be yellow with brownish margins and to be arranged in 15–16 series.

MALAYA: Johore, Sungai Kavu (Kiah 32,310).

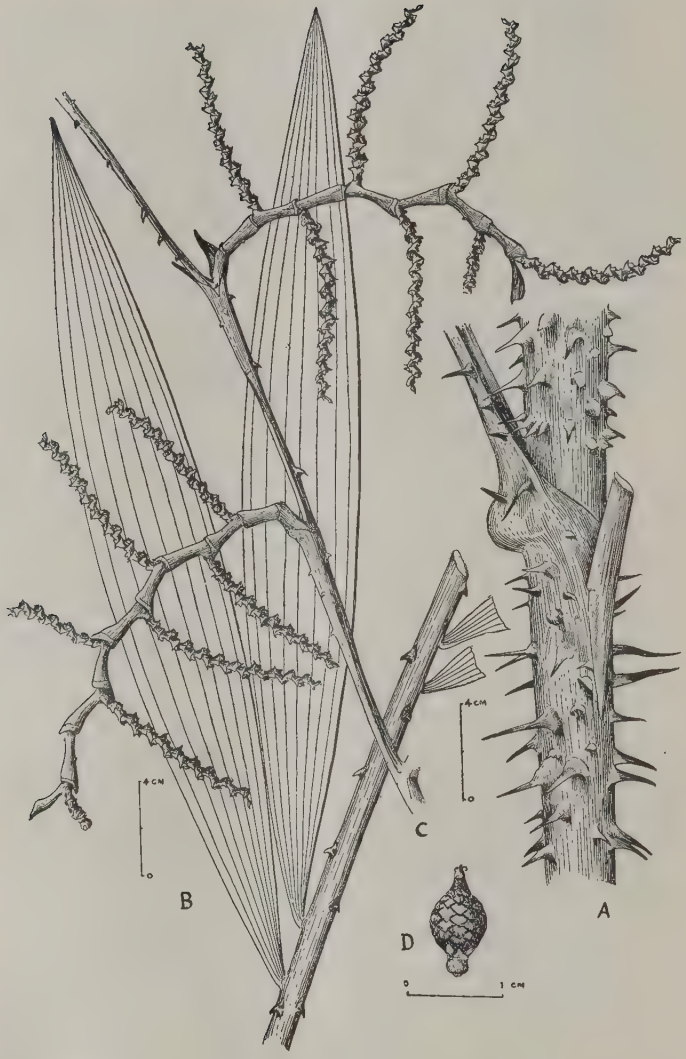
From *C. Hendersonii* this differs in having longer spines on the leaf-sheaths, a flat, saucer-shaped involucre, the fruiting calyx truncate at base, and the fruit scales (as counted from the small developing fruits) in 15 series. From *C. axillaris* it differs also in having fewer leaflets (8–12 on each side of the rachis) which are arranged in groups even in the lower-half of the leaf.

21. Calamus tumidus Furtado **spec. nov.—t.t. 21 & 22.**

C. giganteus Becc. *sensu* Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 441 pro parte.

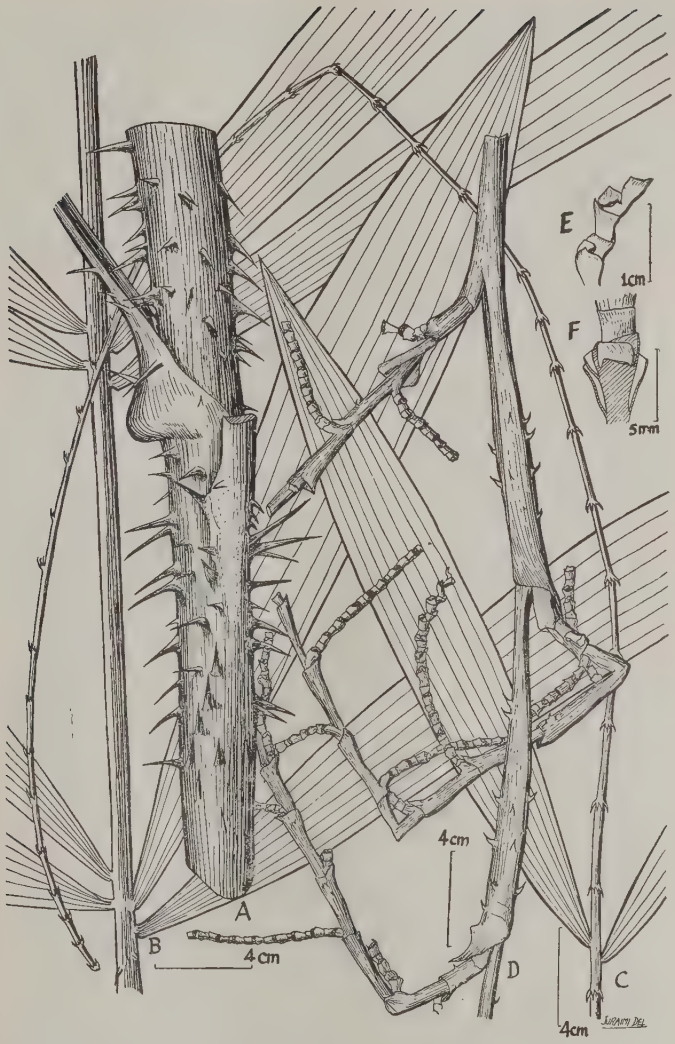
C. ornatus Griff. *sensu* Ridl., Mat. Fl. Malayan Pen. II (1907) 195 et Fl. Malay Pen. (1925) 53 pro parte.

A. C. Manan, *cui affinissima, haec species minus armata, secus vaginae margines et in superficie petioli superiore inermis; vaginae aculeis lignosis fere non-elasticis; foliolis fasciculatis, saepissime*



Tab. 21. *Calamus tumidus (Ridley 11,203 partim).*

A, Fragmentum caudicis cum vagina et geniculo. B, Frondis fragmentum. C, Spadicis fragmentum (an C. tumidus?) D, Ejusdem fructus.



Tab. 22. *Calamus tumidus (Corner & Furtado 29,474—holotypus).*

A, Caudicis fragmentum ut vagina et geniculum appareant. A, Frondis fragmentum mesiale. C, Frondis fragmentum apicale. D, Spadicis pars feminei. E, Spiculae pars ut spathella, involucrophorum et involucrum appareant. F, Idem verticaliter discissa.

geminatis sat distincta. A C. palustri *cui in frondium facie simillima, geniculo vaginali basi abrupte inflato rotundato, in petiolum sensim exeunte, foliolis bicoloribus haec species dissimillima.*

Caudex solitarius scandens, circa 20–30 m. longus, cum vaginis circa 4 cm. in diam. *Vagina* lignosa, aculeis triangularibus, inaequalibus ad 3 cm. longis, distantibus, saepe minoribus, oblique fere sitis praedita, ad petioli basin subito valde gibbosa et infra horizontaliter semi-annulata, petiolum versus rotundato cuneata. *Ocrea* brevissima, lignosa, decidua. *Frondes* in parte pinnifera metrales vel longiores, in cirrum longum unguibus atris digitatis armatum terminatae; petiolus usque ad 40 cm. longus, basi 2–2·5 cm. latus, secus margines tantum armatus; rachis triangularis, secus margines dorsales tantum unguibus solitariis vel digitatis armata. *Foliola* numerosa, fasciculata, saepissime geminata, paulo divergentia subopposita, 12–20 cm. inter se remota, elongato-elliptica, untrinque sensim cuneata papyracea, longitudinaliter plicatula, subtus glaucescentia (in juvenilibus secus marginem inferiorem linea polita una vel magis notata), untrinque inermia, apicem versus deciduo setosa, 7–11 costata, apicalia minima, altera subaequalia, maxima 40–50 cm. longa, 6–7 cm. lata. *Spadix femineus* haud flagelliformis, crassus, frondibus multo brevior, in appendicem brevem exeuns, breviter pedunculatus, unguibus solitariis validis in appendice digitatis, in ramis primariis 4–5 divisus. *Spathae primariae* basales duae, bicarinatae 4–8 longae, secus carinas aculeatae; alterae spathae 7–15 cm. longae cylindricae, basin versus angustatae, unguibus solitariis armatae, apice oblique truncatae ligulatae. *Rami primarii* ad 25 cm. longi, utrinsecus spiculas alternas ferentes, ad spathae apicem orientes; spathae secundariae conformes, 2–4 cm. longae, inermes vel paulo aculeatae. *Spiculae* 8–10 cm. longae, floribus utrinsecus circa 10 distichis; spathellae infundibuliformes, apice truncatae, ligulatae, striatae. *Involucrophorum* cupulare; involucrum oblique cupulare, immersum; areola semilunaris, ad involucrophori marginem attingens. *Fructus* floresque ignoti.

Stem solitary, climbing, 20–30 m. long, about 4 cm. through. *Leaf-sheaths* woody, armed with stout, usually solitary, somewhat oblique, unequal 1–3 cm. long, spines, smooth and unarmed at the mouth, swollen abruptly into a horizontal and semi-annular geniculum, rounded and then merging gradually into the petiole. *Ocrea* short, deciduous. *Leaves* very long, terminating into a long cirrus; petiole about 40 cm. long, perhaps shorter in older leaves, stout armed along the margins only; claws on the pinniferous rachis simple and marginal, but digitate in terminal parts of the leaf and in cirrus. *Leaflets* many, fasciculate, often geminate, almost opposite, elongate-elliptic, papery, longitudinally plicatulate, whitish below, 7–11 costate, setose along the margins at apex, terminal smallest; others subequal, the largest 40–50 cm. long, 6–7 cm. broad. *Female spadix* much stouter than the leaf-rachis or petiole, ending in a short appendix, divided in 4–5 branches or more; the two basal spathes bicarinate, 4–8 cm. long, aculeate along the ridges; other primary spathes 7–15 cm. long, cylindrical, narrowed towards the base, armed with solitary claws, obliquely truncate and ligulate at apex. *Primary branches* up to 25 cm. long, arising at the mouth of the spathe, bearing 4–5 alternate spikelets on each side; secondary spathes similar, 2–4 cm. long, armed or unarmed. *Spikelets* 8–10 cm. long, with about 10 distichous flowers on each side; spathels funnel-shaped, ligulate, striate. *Involucrophore* deeply cupular; involucre obliquely cupular, immersed; areola semi-lunar, reaching to the surface of the involucrophore. *Flowers* and *fruits* unknown.

MALAYA: Johore, Sungai Kayu Ara (Corner & Furtado 29,474 sub nom. vern. *Rotan Manau Liki,* holotypus); Kuala Tebing Tinggi (Ridley 11,202 et 11,203 partim).

This species is easily distinguished by its geniculum (gibbosity on the sheath) being abruptly and almost uniformly swollen, giving the appearance of a horizontal, semi-circular ring at the base of the petiole; and by its leaflets being whitish underneath. It is quite common at Sungei Kayu Ara, but it was rarely seen in flower. The difficulties of getting it in flower, and also the fact that the species is confused with others, might be the reasons why collections of the species are so few and meagre. In the specimen collected by Corner and myself, the spadix was already dead and it was not possible to get it in a way to show its full details. It was noticed that the petioles tend to be shorter in the leaves produced in higher parts of the stem.

In certain respects this species has the characters of *C. palustris* which, according to Beccari, varies considerably though it is sparsely represented in herbaria. In order to provoke further studies it has been named here as a distinct species on account of the peculiar gibbosity of the sheath. From *C. ornatus*, with which this species has been confused, *C. tumidus* differs in the long cirrus of the leaves and short, non-flagelliferous spadices; from *C. Manan* of which *C. giganteus* appears to be a subspecies or a variety, *C. tumidus* differs in its fascicled bicolored leaflets, its peculiar shaped geniculum, and fewer spines on the sheaths. I have not seen any other large Malayan species which has a geniculum shaped similar to this, but *C. formosanus* from *Formosa* (Taiwan) is depicted by Beccari with a similar shaped geniculum.

Ridley 11,203 (leaf only) belongs here. Another sheet containing a portion of spadix with small immature fruits bears the same number. In the general appearance of its spikelets and spathes, this latter specimen may be easily confused with that of *C. giganteus*; but the fruit-scales are distinctly yellow with dark margins, and this despite the fact that the fruits in the specimens are smaller than those available of *C. giganteus*. The fruit scales are disposed in 12–13 vertical series. The involucre is developed and exsert. Could it be that the involucre which is hollow and included in the type of *C. tumidus* develops later and becomes exsert as in Ridley 11,203? Better specimens are needed to settle this problem. I have therefore not quoted Ridley 11,203 (spadix) as a syntype of *C. tumidus*.

22. Calamus Manan Miq. in Journ. de Bot. Neerl. I (1860) 28 et Prodr. Fl. Sum (1860) 256 et 595; Becc. in Rec. Bot. Surv. Ind. II (1902) 211; Ridl., Mat. Fl. Malayan Pen. II (1907) 196 pro parte typica; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 438 t. 196 et Suppl. (1913) 109; Ridl., Fl. Malay Pen. V (1925) 53 pro parte typica.—**t. 23.**

Stem scandent, solitary, about 15 m. long, and 7–9 cm. in diam. *Leaf-sheaths* strongly gibbous, strongly armed with numerous spines which are laminar, unequal, up to 2·5 cm. long, slightly reflexed or ascendent, blackish, irregularly margined, solitary or approximate in irregular rows; along the margins the spines are short and oblique, often broader than long. *Ocrea* fibrous, extending all along the margins, deciduous. *Leaves* very long, terminating in a very long, stout cirrus; petiole short, 6–10 cm. long, armed in the lower part and often also above with short, laminar approximate spines; rachis gradually becoming almost triangular or nearly cylindrical in the terminal part, armed like the petiole in the basal portion, armature disappearing in the upper surface, but in the lower, claws simple in the basal part, digitate and half-whorled in the distal parts and in the cirrus. *Leaflets* numerous, unequal, subequidistant, 6–10 cm. apart, drooping, papyraceous, elongate-elliptic, broadly lanceolate, glaucous beneath, plicate many nerved, unarmed on both surfaces; transverse nerves conspicuous; margins remotely and adpressedly spinulous in the lower half, unarmed in the upper except for the setae towards the apex and at its summit; the largest leaflets mesial, 50–70 cm. long, 5–6 cm. wide. *Female spadix* shorter than the leaves, non-flagelliferous with robust axis, 3–4 m. long, divided into many primary branches 15–25 cm. apart. *Primary spathes* short, coriaceous, basal one bicarinate, others cylindrical, somewhat funnel-shaped, armed densely with solitary claws. *Primary branches* 80–85 cm. long, with 8–9 spikelets on each side, terminating into a small appendix; secondary spathes coriaceous, slightly funnel-shaped, closely sheathing, armed with solitary or confluent spines, truncate, shortly ligulate, ligule marcescent. *Spikelets* up to 25 cm. long with 15–16 bifarous, remote flowers on each side; spathels shortly tubular, funnel-shaped, unarmed, slightly ligulate at the mouth. *Involucrophore* almost exsert, shortly cupular, bidentate; involucre cupular, entire or bidentate. *Female flowers* 5–6 mm. long. *Fruiting perianth* distinctly pedicelliform; calyx polished, nearly as long as the corolla. *Fruit* ovoid-elliptic, 30–35 mm. long, 20–22 mm. broad, equally rounded at both ends, shortly beaked; scales in 15–18 series, straw-coloured with dark marginal line; seed with deeply ruminated albumen and lateral embryo. *Male spadix* about a metre long, covered all over with deciduous brown scurf, ending in a 40–50 cm. long prickly appendix. *Primary spathes:* the basal one and the one above the first branch bicarinate, 8–15 cm. long; other primary spathes subequal, cylindrical, all ligulate at the apex, all stoutly armed with claw-like solitary prickles. *Primary branches* 4–5, each arising at the mouth of its own spathe, 30–50 cm. long, each divided into 15–17 secondary branches; secondary spathes 2–3 cm. long, broad funnel-shaped, striate, unarmed, with a marcescent ligule and scariose margins. *Secondary branches,* if florigerous 3–4 cm. long, but usually spiculiferous and then 10–15 cm. long; tertiary spathes 6–8 mm. long broadly funnel-shaped, striate, apiculate on one side. *Spikelets* flattened, 1·5–2 cm. long, with 8–12 closely packed, distichous flowers on each side; spathels bracteiform, concave, extended and apiculate on one side; involucre half enclosed in the spathel, cupular. *Male flowers* 4–5 mm. long; calyx striate, half as long as the corolla, the latter not striate.

MALAYA: Kemaman, Bukit Kajang, alt. circa 150 m. (Corner 30,468, male as *Rotan Manau*).

DISTRIBUTION: Sumatra and Bangka.

This is a first definite record, I think, of the occurrence of this species in the Peninsula. The specimens referred by Ridley to this species are *C. giganteus* which Beccari has kept separate, though admitting that it might be considered as a variety of *C. Manan*. Ridley seems to have confused these species with *C. ornatus*.

The description given by Beccari was based on a female specimen from a plant growing in Buitenzorg Gardens, but it was compared with the type material extant in the herbaria of Leyden, Utrecht and Calcutta. Like the other solitary stemmed species in this group, this does not bear flowers and fruits profusely at any one time, a reason why such solitary stemmed species are very poorly represented in herbaria. The male plant is described for the first time here.

23. Calamus giganteus Becc. in Hook. f., Fl. Brit. Ind. VI (189) 460 in Rec. Bot. Surv. Ind. II (1902) 215, in Ann. Roy. Bot. Gard. Calc. XI (1908) 440 pl. 197 pro parte, et Suppl. (1913) 109 p.p. (ex altera parte = *C. tumidus*).

C. ornatus Bl. *sensu* Ridl., Mat. Fl. Malayan Pen. II (1907) 196 et Fl. Malay Pen. V (1925) 53 pro parte.

C. Manan Miq. *sensu* Ridl., Fl. Malay Pen. V (1925) 53 pro parte.

Stem solitary, 20–30 m. long, 6–9 cm. in diam. *Leaf-sheaths* gibbous, armed with very unequal, up to 3 cm. long, laminar, broad-based blackish spines that are solitary or approximate in interrupted series; the larger spines usually deflexed, the very small ones ascendent. *Ocrea* fibrous, marcescent, extending all along the rim of the sheath, deciduous. *Leaves* 3–4 m. long terminating in a 3–4 m. long cirrus; petiole 15–22 cm. long, about 3–5 cm. broad at the base, armed with short robust spines in the upper and the lower surfaces; rachis robust, armed with solitary, distant, black-tipped claws on both surfaces towards the basal end, but only on the lower surface in the distal end, where the claws become digitate or half-whorled as in the cirrus. *Leaflets* numerous, whitish beneath, drooping, unequal, and subequidistant, papyraceous, elongate-elliptic or lanceolate-ensiform, 5–11 costate, smooth on both surfaces and along the margins, but deciduously bristly at the apex; the largest mesial, 50–60 cm. long, 6–7·5 cm. wide; transverse veinlets not very conspicuous. *Female spadix* shorter than the pinniferous part of the leaf, terminating in a short aculeate appendix, deciduously dirty brown furfuraceous in all parts. *Primary spathes* closely sheathing, tubular; the first two flattened, bicarinate, sparsely armed, 10–15 cm. long, others elongate funnel-shaped, densely armed with scattered robust prickles, dorsally keeled. *Primary branches* 40–70 cm. long, 20–30 cm. apart, terminating in a short aculeate appendix, each branch bearing on each side 6–10 distichous spikelets; secondary spathes 2·5–4 cm. long, irregularly armed, apiculate, marcescent on the margins. *Spikelets* 10–15 cm. long, with 14–18 distichous flowers on each side, spathels broadly funnel-shaped, furfuraceous, striate, unarmed. *Involucrophore* cupular; involucre slightly exsert, cupular. *Fruiting perianth* distinctly pedicelliform; calyx nearly as long as the corolla. *Fruit* 28 mm. long, ovoid-elliptic, immature; scales yellowish probably brown with almost black margins arranged in 15 vertical series; seed immature. *Male spadix* covered on all parts with dirty brown deciduous furfur, 1–1·75 m. long, divided into 6–7 primary branches, terminating with an obscure appendix; peduncle about 15 cm. long. *Primary spathes* one or two on the peduncle, flattened, bicarinate; others cylindrical, all armed with stout prickles, marcescent at the apex. *Primary branches* 50–70 cm. long, divided into about 8

Tab. 23. *Calamus Manan (Corner 30,468).*

A, Caudicis fragmentum ut vagina et geniculum appareant. B, Frondis fragmentum mesiale. C, Spadicis fragmentum basale masculi. D, Spicula ut dispositio florum appareat.

alternate, secondary branches on each side; secondary branches 10–25 cm. long, bearing alternate spikelets about 1·5 cm. apart; tertiary spathes about 8 mm. long, apiculate, striate; spathels bracteiform, concave, extended and apiculate on one side. *Male flowers* about 5 mm. long; calyx obscurely striate, arcuately short-lobed, nearly half as long as the calyx.

MALAYA: Pahang, Sungai Kessar at Bentong, alt. 600 m. (Furtado 33,107 male). **Perak,** loc. incert. (Scortechini, Herb. Becc. Holotype). **Negri Sembilan,** Bukit Senaling in Kuala Pilah (Moorhouse as *Rotan Manok* or *Rotan Kilikek*). **Singapore,** Botanic Gardens, cultivated ?, (Ridley 13,338).

I have not seen Scortechini's specimen which is the type of the species, so I have followed the description and the author's excellent plate of the type. I have not seen Moorhouse's specimen cited by Ridley as *Rotan Manor Telor* under *C. Manan*, but Moorhouse's specimen from the same locality cited under *C. ornatus* apparently belongs here, and Ridley has combined the two vernacular names *Rotan Manok* and *Rotan Kilikek* or *Kelicket* as *Rotan Manok Kelichet*. As noted by Beccari, *C. giganteus* may be considered as a variety of *C. Manan*, but I think it is advisable to keep this form distinct until better specimens of both these species enable us to study the range of the variation under each. Otherwise the closely allied species and varieties of this group might not receive due attention from the botanical collectors. Apparently all these large species are of some commercial importance and there may be some corresponding difference also in the commercial value of the canes. The fruits available are all young and have black scales which are yellowish at the base.

(b) Sectio PHYLLANTHECTUS subsectio CIRRULIFERUS Furtado **subsect. nov.**

Caudex gracilis. *Frondes* foliolis fasciculatis saltem basin versus praeditae, inter minores, spadicibus paulo longiores vel aequilongae, breviter cirriferae, subcirriferae vel ecirriferae. *Spadices* graciles, pro rata longe pedunculati, spines debilibus armati vel non, erectiusculi vel funiformes. *Perianthium fructiferum* explanatum vel fere.

DISTRIBUTIO: Malaya, Borneo et Java.

SPECIES TYPICA: *C. viridispinus.*

Malayan species of this subsection are very variable and collectors seem to overlook the differences, even when they are specific; sometimes specimens from different species are also found mixed. In order to provoke a further study I have named specifically the extreme range of variations which further studies may show them no more than mere edaphic forms of the same species. *C. elegans* is an acaulescent or nearly erect rattan having neither a cirrus nor a flagellum; but the spadices are very much smaller than the leaves.

Key to the Species

A. Stemless or short-stemmed, erect. Petiole 50–100 cm. long. Leaves without a cirrus or subcirrus. (Leaflets 13–25 cm. long, 10–12 mm. broad; apical leaflets free.).

C. elegans Ridl. **emend.** Furtado.

AA. Stem scandent. Petiole 40 cm. or considerably shorter. Leaves cirriferous or in *C. brevispadix* subcirriferous.

(a) Leaflets elliptic-lanceolate or broadly linear-lanceolate often 3–7 costulate. Spadix about 1 m. long, pendulous.

(b) Leaflets broadly linear-lanceolate, 25–40 cm. long, most in fascicles of 3. (Petiole 10–40 cm. long).

C. viridispinus Becc.

(bb) Leaflets elliptic-lanceolate, 10–20 cm. long, mostly 2 per fascicle. (Petiole about 8 cm. long, or even less).

(c) Leaflets in opposite groups. Leaf-sheaths straw coloured, spines on leaf-sheaths and petiole-bases ± 2 cm. long, light-coloured (Spadix about 1 m. long or less).

C. distichus Ridl.

(cc) Leaflets in alternate groups. Leaf-sheaths dark brown, spines on leaf-sheaths and petiole-bases up to 3 cm. long schistose (Spadix more than 1 m. long).

C. distichoideus Furtado.

(aa) Leaflets linear-lanceolate, mostly narrow, 1–3 costulate (mostly 3 or more in per fascicle). Spadix 50 cm. long or less, erectish. (Leaves cirriferous, but subcirriferous in *C. brevispadix*).

(f) Leaflets 10–20 cm. long, rarely more

(g) Petiole 10 cm. or less long. Leaflets 7–20 cm. long. Spadix unarmed or armed only at base. Male flowers distant.

(h) Leaflets 7–15 cm. long.

C. oreophilus Furtado.

(hh) Leaflets ± 20 cm. long.

C. bubuensis Becc.

(gg) Petiole 25–40 cm. long. Spadix more or less weakly armed. Male flowers pectinate.

C. Koribanus Furtado.

(ff) Leaflets 25–40 cm. long (Petiole 15–40 cm. long).

(i) Leaflets setose on the costae above. Fruit with dark brown concolorous scales (Leaves subcirriferous).

C. brevispadix Ridl.

(ii) Leaflets not setose above. Fruit scales yellowish with darkish margins. (Leaves apparently cirriferous).

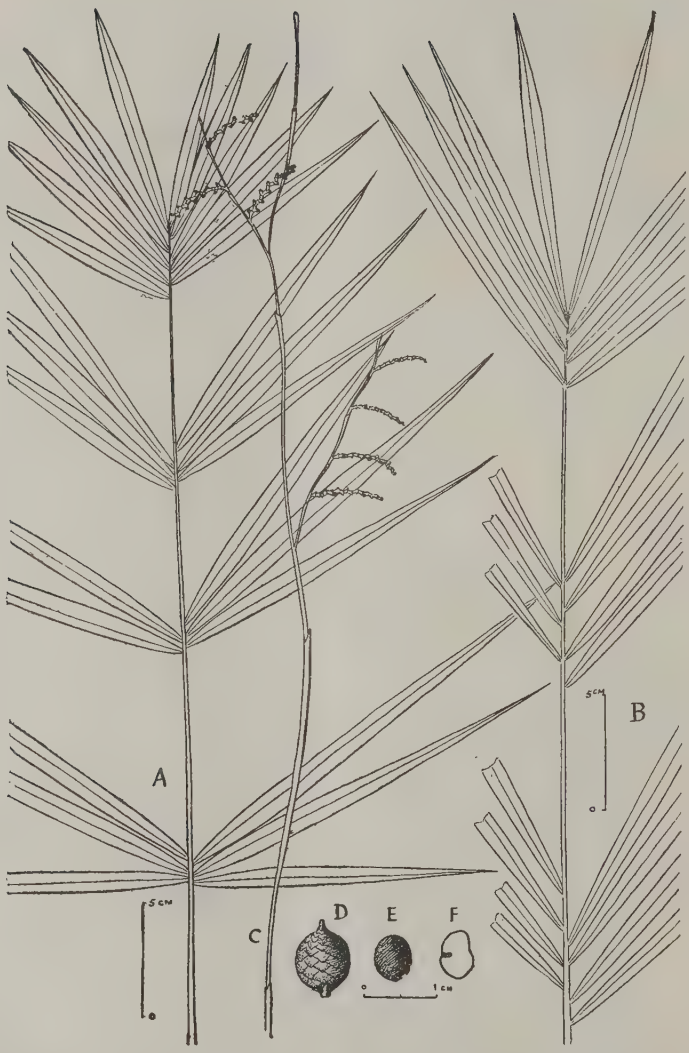
C. benomensis Furtado.

ENUMERATION OF THE SPECIES

24. Calamus elegans Ridl. **emend.** Furtado—**t. 24.**

C. elegans Ridl., Mat. Fl. Mal. Pen. II (1907) 207 quoad specimen Ridleyanum tantum, in Journ. F.M.S. Mus. IV (1909) 87 partim excl. descriptione nova, et IV (1915) 189 partim, et Fl. Mal. Pen. V (1925) 61 quoad specimen perakense tantum.

Caudex acaulescens, vel erectiusculus ad usque 20 cm. longus, circa 1–1·5 cm. in diam., soboliferus, radicibus epigeis pluribus praeditus. *Vagina* frondium haud gibbosa, fere ad basin aperta, aculeis usque ad 5 mm. longis, solitariis vel aggregatis, laminaribus vel margines ejus secus setiformibus armata, brunneo-furfuracea, 10–15 cm. longa. *Ocrea* liguliformis ad 1·5 cm. usque longa, mox marcescens, furfuracea, basi setosa. *Frondes:* petiolus fere quadrangularis, circa 50–100 cm. longus, in latere ventrali leviter canaliculatus, in planta juvenili basin versus utrinsecus aculeis ad 2·5 cm. usque longis armatus, in planta adulta inermis vel infra medium utrinsecus aculeolis 1–4 mm. longis, solitariis, 3·5–10 cm. inter se remotis praeditus; lamina 30–45 cm. longa, secus rachin fugaceo-leprosa, inermis. *Foliola* in rachide utrinsecus 15–20, in gregibus 2–4 foliolatis oppositis vel sub-oppositis disposita, unicostulata, linearia, mediana maxima 13–25 cm. longa, 10–12 mm. lata, in pagina inferiore inermia, ad basin fugaceo-furfuracea, in pagina superiore apicem versus secus costam marginesque fusco-spinulosa vel interdum non; fasciculus apicalis plerumque 4–6 foliolatus cum duobus foliolis terminalibus minimis liberis, greges basales duo-foliolati. *Spadix femineus* masculo similis, gracillimus, inermis vel obscure vel parcissime aculeolatus, frondibus multo brevior, 35–60 cm. longus, apicem versus in spiculas 2–5 vel in ramos spiculiferentes divisus; spathae



Tab. 24. *Calamus elegans (A, D–F: Ridley 16,290; B, C: Ridley, sn.— lectotypus).*

A & B: Folia. C, Spadix. D, Fructus. E, Ejusdem semen. F, Idem verticaliter discissum.

primariae et secundariae inermes, cylindrico-tubulosae, striatae, fugaceo brunneo leprosae, apice oblique truncatae; rami spiculiferentes ad 10 cm. longi, supra spathae apicem orientes, porrecti, utrinsecus spiculis 3–4 alternatis praediti. *Spiculae* ad 6 cm. usque longae, femineae masculis nonnihil minores, utrinsecus cum floribus 4–10 alternatis. *Involucrophorum* vix exsertum, supra spathellae apicem propriae oriens, ad spathellae basin superioris adnatum, excavatum; involucrum conforme. *Perianthium fructiferum* basi callosum, supedicelliforme. *Fructus* oblongus, circa 10 mm. longus, 6–8 mm. in diam; squamis per series 12–13 verticales dispositis, canaliculatis, stramineis, secus margines brunneis; albumine homogeneo; embryone supra basin fere ad medium seminis sito.

Stem tufted, very short, up to 20 cm. long, erect, supported by epigeous roots. *Leaves* 80 cm.–1·40 m. long including 50–100 cm. long petiole, non-cirriferous; spines on the petiole of juvenile leaves up to 2·5 cm. long, smaller or absent in adult leaves; rachis fugaceously leprous, unarmed. *Leaflets* 15–20 on each side of the rachis, arranged in 4–6 opposite or subopposite groups, in the terminal group 4–6, in the basal group 2, in the mesial 3–4 leaflets, setose only along the margins and the median nerve above, the largest mesial, 13–25 cm. long, and 10–12 mm. broad. *Spadix*, female and male somewhat similar, slender, shorter than the leaves, 35–60 cm. long, divided into 2–5 simple spikelets, each 4–6 cm. long, or spikelet-bearing branches up to 10 cm. long (female spikelets much shorter than the male). *Fruit* oblong about 10 mm. long, 6–8 mm. in diam.; scales straw-coloured, brownish along the margins, disposed in 12–13 vertical series. *Seed* with homogeneous albumen.

MALAYA: Perak, Bujong Malacca (Ridley in 1898—lectotype). **Pahang,** Gunong Tahan alt. ± 1,200 m. (Ridley 16,290; Wray et Robinson, 5,427 partim; Haniff & Nur 8,124; Holttum 20,586; Corner 30–IX–1937; Batten-Pool in Nov. 1939–Jan. 1940).

There has been a good deal of confusion over this species, for which its author himself is largely responsible. The original description was compounded of three specifically different elements: Wray 3,923, Scortechini 316[a] (a sketch) and Ridley s.n. (from Bujong Malacca), all characterised in having small leaves with fascicled leaflets. In a note to the original description the author stated that he was not sure of the specific identity of Wray's specimen, and indicated separately the parts of the description referring exclusively to Wray's specimen.

In 1913 Beccari (Ann. Roy. Bot. Gard. Calc. XI App. pp. 101 & 102) showed that Wray's and Scortechini's specimens were respectively *C. bubuensis* Becc. (then reduced to *C. brevispadix* Ridl.) and *C. viridispinus* Becc. But four years before this, and unknown to Beccari who had named for Ridley many Malayan specimens, Ridley (1909 l.c.) gave what purported to be a more detailed description of *C. elegans*, based on specimens collected by him in 1908 in the Telom Valley of Pahang. Here he excluded Scortechini 316[a] as doubtful and omitted to mention also Wray 3,923 probably as a result of the information given by Beccari in letters that this was his *C. bubuensis*. But the Telom specimens which have cirriferous leaves, are not identical with any of the

original syntypes, but represent a new species *C. Koribanus*. This description of 1909 is the one that has been adopted by Ridley in his Flora (1925). But in interpreting *C. elegans* Ridl., I have excluded the Telom specimens altogether, since they do not form a part of the protologue; instead I have selected as the lectotype the Bujong Malacca specimen, a syntype having non-cirriferous leaves, for this was the only specimen in the protologue which Ridley could study and describe accurately, and it is also the one that remained after the exclusion of the other two syntypes by Beccari.

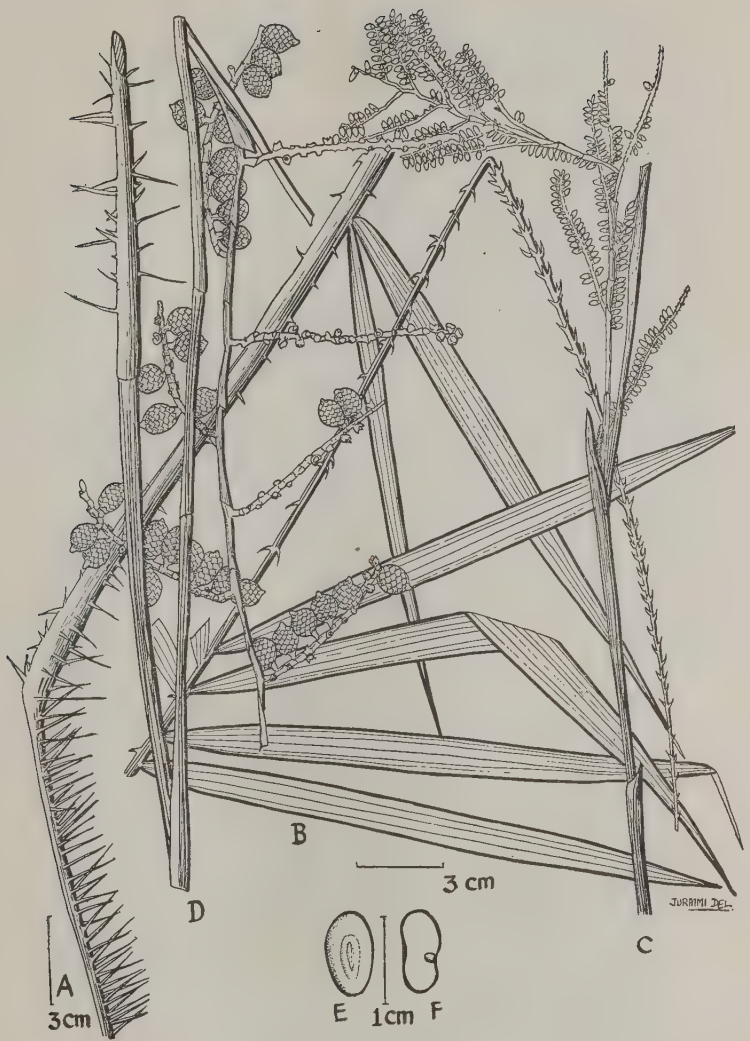
In view of this typification a new description has been given here. The spadix originally described as male by Ridley is really female having small undeveloped flowers. The species appears to be very closely allied to *C. Helferianus* which appears also to belong to this subsection.

The name *C. elegans* seems to have been used earlier in horticulture, but apparently it has never been validly instated so as to make Ridley's binominal a later homonym.

25. Calamus viridispinus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 458 et in Rec. Bot. Surv. Ind. II (1902) 213; Ridl., Mat. Fl. Malayan Pen. II (1907) 207; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 418 t. 184 et Suppl. (1913) 102; Ridl., Fl. Malay Pen. V (1925) 61 p.p.—**t. 25.**

C. elegans Ridl., Mat. Fl. Malayan Pen. II (1907) 207 quoad specimen Scortechianum tantum.

Stems slender, scandent, up to 7 m. long, 1–1·5 cm. in diam. *Leaf-sheaths* non-flagelliferous, somewhat gibbous, obliquely truncate, rusty-furfuraceous, densely armed with unequal, greenish-brown or schistaceous spines: largest spines flat-based, scattered or horizontally approximate, ascendent or deflexed, mixed with smaller ones. *Ocrea* deciduous, armed with small, soft brown bristles. *Leaves* 40–60 cm. long, ending in a ± 30 cm. long cirrus, armed with simple or digitate, black-tipped claws; petiole 10–25 cm. long, flat above, convex below, armed with 5–15 mm. long, spines along the dorsal margins, occasionally with claw-like simple spines in the middle; rachis armed with non-digitate claws, distally and irregularly spread along the margins and dorsum. *Leaflets* in 4–6 distant groups on each side of the rachis, 2–6 in each group, inequidistant, 1·5–3 cm. apart ensiform or linear-lanceolate, sometimes nearly elliptical and less acuminate, papyraceous, 3–5 costate, longitudinally plicatulate, aculeate along the costae above, smooth beneath, occasionally setose along the margins; transverse veins conspicuous; the largest leaflets 30–35 cm. long, 2–2·5 cm. broad. *Spadix* male and female somewhat similar, flagelliform, as long as or slightly longer than, the leaf, armed at the very base, and occasionally in the terminal appendix, divided into 3–4 spikelet-bearing, 20–30 cm. long branches. *Spikelets* 5–10 cm. long deflexed, flowers bifariously disposed, 10–25 on each side. *Involucrophore* and involucre sessile and cupuliform. *Fruiting perianth* campanulate, split, subcallous at the very base. *Fruit* obovate oblong, 11–15 mm. long, 6–8 mm. in diam., beaked; scales in 12 series, straw-coloured with dark brown margins. *Seed* oblong, somewhat flattened, with equable albumen and with lateral embryo.



Tab. 25. *Calamus viridispinus (A–C: Burkill & Haniff: 12,901; D–F: Ridley 5,203).*

A, Petiolus cum vaginae parte et duobus foliolis. B, Frondis fragmentum apicale. C, Spadix masculus. D, Spadix fructiferens. E, Semen. F, Idem verticaliter discissum.

MALAYA: Perak, above Maxwell's Hills (Ridley 11,985); Maxwell Hill (Ridley 3,494); Burkill and Haniff 13,188); Birth Hill, alt. 1300 m. (Burkill & Haniff 12,901); Taiping Hills (Ridley 5,203 & 11,413; Haniff & Nur 2,321); Gunong Hijau, alt. 1400 m. (Burkill & Haniff 12,767; Anderson 21); Larut Hills by the Mengkaram River (Anderson 167).

Here appears to belong a spadix collected without leaves by Curtis in Langkawi in 1889.

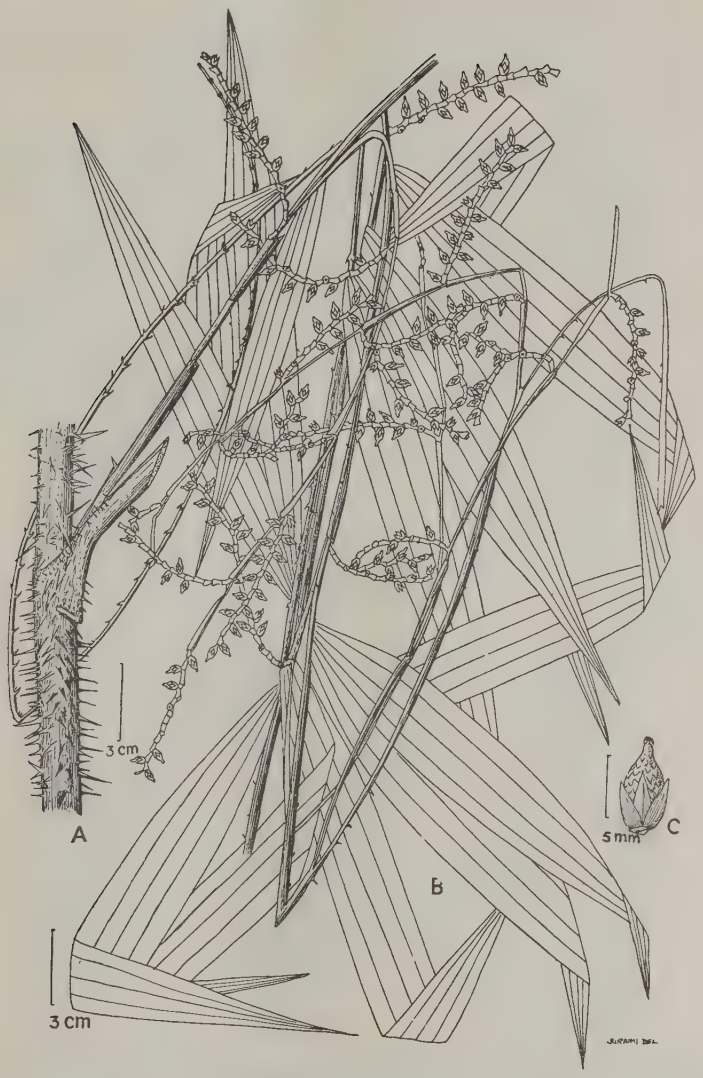
The leaflets are very variable in shape, some are gradually cuneate and almost linear, others are elliptically cuneate and less acuminate; it is possible that this variation is due to age. In armature of the petiole, some specimens would agree with the description of *C. viridispinus* var. *sumatranus* Becc., but the leaflets in this are described as having no armature in either surface. The type of this species is Scortechini 316[a] collected on Gunong Tambang Batak, Perak in Herb. Becc., the drawing of which was included as a syntype of *C. elegans* Ridl.

26. Calamus distichus Ridl., Mat. Fl. Malayan Pen. II (1907) 206; Becc. in Ann. Roy. Bot. Gard. Calc. XI Suppl. (1913) 96 t. 54; Ridl., Fl. Malay Pen. V (1925) 60.—**t. 26.**

Stem scandent, about 1·5–2 cm. in diam. *Leaf-sheaths* gibbous, armed with flat, sub-equal, up to 1·5 cm. long, nearly horizontal, spines. *Ocrea* very short, or obscure. *Leaves* shortly cirriferous, 30–60 cm. in the pinniferous part, armed along the rachis below with solitary or digitate claws; petiole 3–6 cm. long, armed along the dorsum and the margins with short unequal spines. *Leaflets* in groups of usually 2, rarely 1 or 3, nearly approximate at the base, somewhat divergent above, elliptic-lanceolate, longitudinally plicatulate, often hollow or cochleariform below, the largest 22 cm. long, and 3·7 cm. wide, 3–5 or more nerved above, smooth on both surfaces. *Female spadix* 75–100 cm. long, pendulous, armed at the base and on the axis of the upper parts also, ending in a short unarmed appendix, divided into 3–4 spikelet bearing erectish branches, each branch 20–40 cm. long. *Primary spathes* closely sheathing, obliquely truncate, more or less ridged, the basal conspicuously bicarinate, armed along the ridges, with short flaccid spines, which become reduced in size and in number in the distal spathes; secondary spathes 3–4 cm. long, similar but narrower, cylindrical, smooth. *Spikelets* alternate, 3–5 cm. apart, 5–10 cm. long, bearing 6–10 alternate flowers; spathels broadly funnel-shaped, smooth, acuminate. *Fruiting perianth* split up to the base; sepals as long as the petals. *Fruits* too young; scales yellow with brown margins, arranged apparently in 17 longitudinal series. *Male plant* like the female, but seems to have smaller leaflets; smaller spadices; broader spathels ending in longer ligules; flowers striate, corolla nearly double the length of the calyx.

MALAYA: Selangor, Ulu Semangkok, alt. 1300 m. (Ridley 12,115, holotype, s.n. paratype). **Pahang,** Pine Tree Hill on Fraser Hill, alt. 1600 m. (Holttum 21,558, female).

This species requires a further study, specially in regard to its variability. The fruits examined by me were just emerging from their respective perianths, and so the details about the arrangement of the scales and their colour should be further studied.



Tab. 26. *Calamus distichus (Holttum: 21,558).*

A, Caudicis fragmentum cum spadice et frondium vaginis. B, Frondis pars cirrum includens. C, Fructus juvenilis.

27. Calamus distichoideus Furtado **spec. nov—t. 27.**

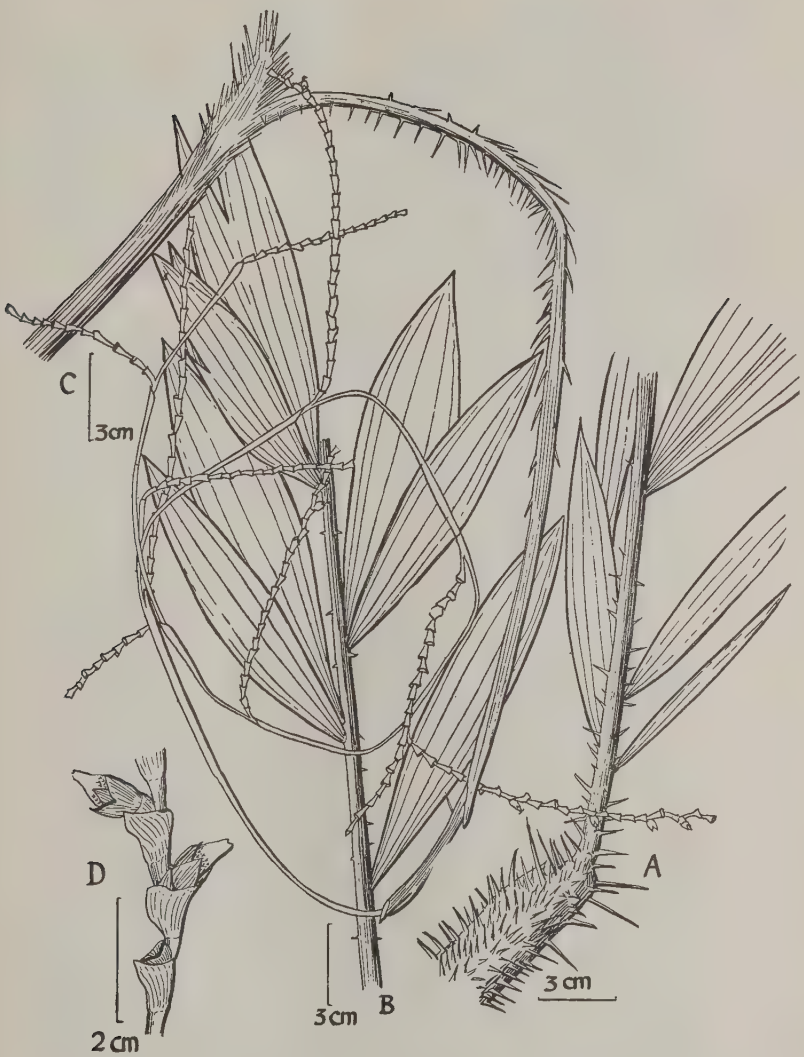
A C. disticho, *cui affinissima, differt vaginae spinis frondalis longioribus; foliolis magis cochleariformi-ellipticis, alternate fasciculatis; spadicibus valde longioribus pendulis; corollis quam calyces longioribus.*

Caudex scandens, cum vaginis 2–3 cm. in diam., circa 5 m. longa. *Vagina* apice gibbosa, spinis ad 2–5 cm. usque longis inaequalibus, vel superioribus longioribus, horizontalibus vel paulo porrectis vel reflexis, schistosis, apice atris, armata. *Ocrea* brevis, coriacea, inermis. *Frondes* cirriferae, in parte pinnifera circa 75 cm. longae, secus rachidis dorsum unguibus solitariis vel digitatis armatae; petiolus (unicus visus), 5 cm. longus. *Foliola* per gregem bina porrecta disposita, gregibus distantibus, alternatis, 3–5 vel 7 costata, utrinque inermia, elliptica, apice setis carentia, subito obtuso-acuminata, subaequalia, coriacea, maxima 16 cm. longa, 4 cm. lata. *Spadix femineus* elongatus, pundulus, fere sesquimetralis, basi tantum armatus, in 3–4 ramos spiculiferentes divisus, pedunculo 20 cm. longo, bicarinato, secus carinas et utrinque spinis 1–2 cm. longis armato suffultus. *Spatha* basalis 20 cm. longa, bicarinata, chartacea, secus carinas spinis flaccidis sparsis armata; alterae primariae spathae non visae, probabiliter inermes vel parce armatae, cylindricae. *Inflorescentiae partiales* pendulae 30–70 cm. longae, inermes, in appendicem inermem 2–3 cm. longam exeuntes. *Spathae secundariae* 5–10 cm. longae, cylindricae, inermes, in uno latere carinatae, vel bicarinatae, vel non, chartaceae, apice oblique truncatae, ad spiculae basin attingentes. *Spiculae* 5–20 cm. longae, floribus alternatis utrinsecus 5–15; spathellae infundibuliformes, ligulatae, striatae. *Involucrophorum* ad orificium spathellae oriens, cupuliforme; involucrum conforme. *Flores feminei* conoidei; perianthium ad basin fere fissum, infimo subcallosum, corolla calyce longior. *Planta mascula* ignota.

Stem climbing, 2–3 cm. through. *Leaf-sheaths* gibbous, armed with unequal, nearly horizontal, flat spines, up to 2·5 cm. long. *Ocreā* unarmed, short, leathery. *Leaves* shortly cirriferous, about 75 cm. long in the pinniferous part, clawed along the rachis below; petiole in one specimen seen 5 cm. long. *Leaflets* disposed in alternate distant fascicles of two each, smooth on both surfaces, 3–7 costate, elliptic, subequal, suddenly ending in an acuminate, blunt, non-bristly point, the largest 16 cm. long and 4 cm. wide. *Female spadix* pendulous, about 1·50 m. long, with a bicarinate, aculeate 20 cm. long peduncle otherwise apparently unarmed in the axis, divided into 3–4 branches. *Spathe* basal bicarinate, chartaceous, armed with a few spines; other primary spathes not seen. *Spadix* branches pendulous, 30–70 cm. long, terminating in a short unarmed appendix; secondary spathes somewhat flattened with one or two ridges, 5–10 cm. long, unarmed, closely sheathing. *Spikelets* 5–20 cm. long, provided with biseriate, alternate flowers, 5–15 on each side; spathels infundibuliform, broadened on one side, ligulate, somewhat striate; female flowers conoidal; perianth deeply split to the subcallous base; corolla about 1 mm. long, longer than the calyx.

MALAYA: Pahang, Fraser Hill, 1300–1500 m. alt. (Burkill et Holttum 8,683).

This may be easily confused with *C. distichus*, from which it differs in having alternate leaflet-fascicles, a longer peduncle, longer pendulous spadix and the branches, and a corolla much longer than the calyx.



Tab. 27. *Calamus distichoideus (Burkill & Holttum 8,683—holotypus).*

A, Frondis fragmentum basale. B, Frondis fragmentum mesiale. C, Spadix femineus. D, Spiculae pars ut dispositio spathellae, involucrophori et floris appareat.

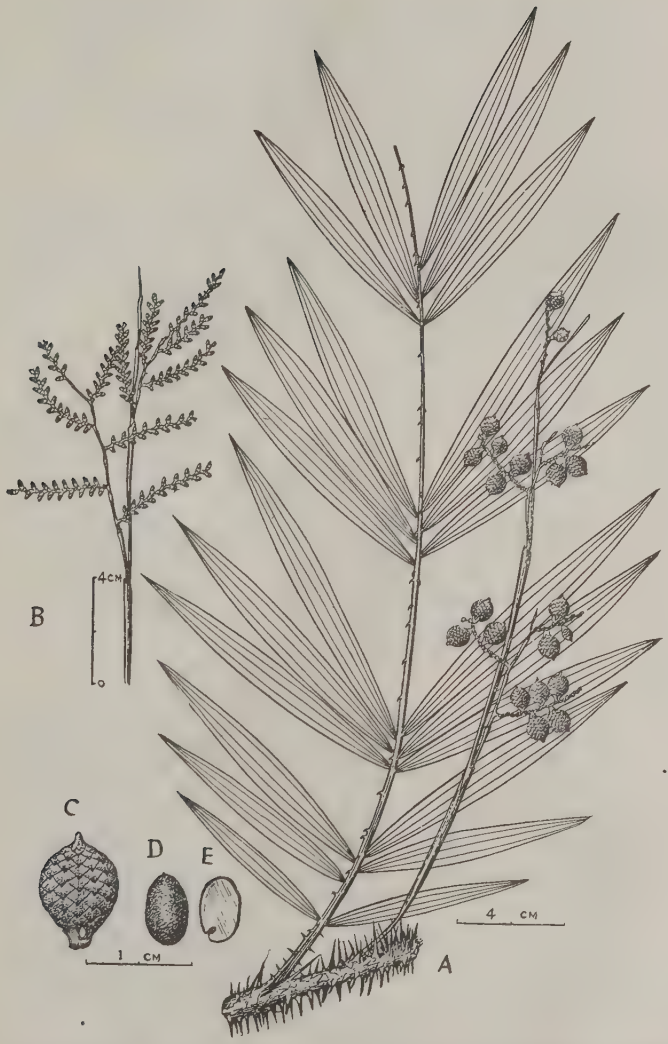
28. Calamus oreophilus Furtado **sp. nov.—t. 28.**

C. elegans Ridl. *sensu* Ridl. in Journ. F.M.S. IV (1909) 87 et VI (1915) 189 et Fl. Malay Pen. V (1925) 61 omino pro parte.

Inter species ad Sect. Phyllanthectum subsect. Cirruliferum pertinentes cum frondibus spadicibus minimis ponenda, sed petiolis 3–6 cm. longis; foliolis ad 15 cm. usque longis, 10–15 cm. latis, conspicue fasciculatis, utrinque inermibus basi in fasciculo valde approximatis; squamis fructus bicoloribus, spadicibus erectiusculis sat distincta. C. elegans *ob frondium spadicumque faciem* C. oreophilo *simillima, differt a hoc caudice nullo vel brevissimo erecto, frondibus ecirriferis secus rachin inermibus.*

Caudex gracilis, scandens, 6–10 mm. in diam. cum vaginis. *Vagina frondalis* haud flagellifera, apice gibbosa, dense spinis ad 1·5 cm. usque longis valde inaequalibus, majoribus triangulatis paulo sinuatis schistosis, summo atris, apicalibus ad 2 cm. usque longis, horizontalibus, vel reflexis aut porrectis praedita. *Ocrea* obscura. *Frondes* cirriferae, secus rachidis dorsum marginesque unguibus solitariis vel digitatis praeditae, parte pinnifera 25–30 cm. longae vel breviores, ex plantis juvenilibus longiores; petiolus 3–5 cm. longus, secus margines armatus; cirrus 25–50 cm. longus. *Foliola* per greges 2–4 fasciculata, gregibus valde distantibus, subaequalia, maxima ad 15 cm. longa, 8–15 mm. lata, utrinque inermia, 1–3 costata. *Spadix femineus* erectiusculus, 20–50 cm. longus, basi tantum armatus vel non, in 2–5 ramos primarios spiculiferentes vel apicales florigerentes 5–15 cm. longos divisus, in appendicem inermem brevem exeuns. *Spathae* primariae cylindricae, oblique truncatae, apiculatae, 4–7 cm. longae; basalis tantum bicarinata basi armata vel non; spathae secundariae 1–2 longae, conformes. *Spiculae* 3–10 cm. longae, utrinsecus floribus alternatis 5–10; spathellae late infundibuliformes apice striatae. *Involucrophorum* cupuliforme, involucrum conforme. *Perianthium fructiferum* fere explanatum vel subpedicelliforme, corolla calyce aequilonga. *Fructus* oblongus vel obovato-oblongus, apice subito rostratus, 12 mm. longus, 6–8 mm.; squamis in series 14–15 dispositis, luteis secus margines brunneis. *Semen* aequabile, embryone ad lateris centrum sito. *Planta mascula* conformis sed differt spadicibus longioribus, spathellis valde striatis longe acuminatis brevioribus; floribus 3–4 mm. longis, corollis luteis haud striatis quam calyces striati duplo longioribus.

Stem scandent, 6–10 mm. in diam. *Leaf-sheaths* non-flagelliferous, gibbose, armed densely with very unequal, up to 1·5 cm. long, schistose, often slightly wavy, black-tipped, almost horizontal spines; slightly longer spines on either side of the mouth of the sheath. *Leaves* cirriferous, 25–30 cm. long in the pinniferous part (longer in young plants), armed along the rachis below and on the cirrus with simple or digitate claws; petiole 3–5 cm. long, armed with short, mostly simple spines or claws. *Leaflets* in distant groups of 2–4 in each, subequal, the largest up to 15 cm. long, 12–15 mm. wide, smooth on both surfaces, 1–3 costate. *Female spadix* 20–50 cm. long, somewhat erect, armed only at the base or unarmed, terminating with a short unarmed appendix, and divided into 2–5 spikelets, each 5–15 cm. long. *Primary spathes* excepting the bicarinate, often armed one at the base, cylindrical, unarmed, closely sheathing, 4–7 cm. long. *Spikelets* 3–10 cm. long, bearing 5–10 alternate flowers in two rows; spathels broadly funnel-shaped. *Fruiting perianth* almost explanate or subpedicelliform.



Tab. 28. *Calamus oreophilus (A, C–E: Ridley 15,935, holotypus; B: Kloss 12,140).*

A, Caudicis pars cum folio et spadice fructiferenti. B, Spadicis pars masculi. C, Fructus cum perianthio. D, Semen. E, Idem verticaliter discissum.

Fruit, the scales in 14–15 series, yellow with dark brown margins; albumen equable; embryo lateral, opposite to the chalazal fovea. *Male plant* like the female, but differing in the longer spadices, shorter, conspicuously striate, long-acuminate spathels, 3–4 mm. long flowers, corolla yellow, not striate, nearly twice as long as the striate calyx.

MALAYA: Pahang, Gunong Tahan, 1000–2300 m. alt. (Ridley 15,935, *Holotypus*; Haniff et Nur 7,955; Corner sub litera A; Wray et Robinson 5,426; Boden-Kloss 12,140). **Trengganu,** Gunong Padang alt. ± 1200 m. (Kiah & Moysey 31,830).

Wray and Robinson's, and Kloss's collections represent male plants. Here appears to belong Ridley's 15,878, collected at the Sempang Mines, Selangor, which differs in its stem being very much thinner and in its leaf-sheaths being considerably less armed, the spines themselves being very small; it may be a very juvenile state of the species, or represent a special variety. Further collections are desired to decide this point.

The species was confused with *C. elegans*, which is a stemless or short-stemmed erect species with no flagellum or cirrus, and without any spines on the leaf rachis, but having spadices and leaves which resemble very much those of *C. oreophilus* and *C. Koribanus*.

29. Calamus bubuensis Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 417 t. 183.—**t. 29.**

C. brevispadix Ridl. *sensu* Becc. in Ann. cit. Suppl. (1913) 101 pp.; Ridl., Fl. Malay Pen., V (1935) 61 p.p.

C. elegans Ridl., Fl. Malay Pen. II (1907) 207 quoad specimen Wrayanum.

Stem slender, scandent, 10–12 mm. in diam. *Leaf-sheaths* densely armed with unequal, horizontal or slightly deflexed, often undulate, 10–15 mm. long, greenish or schistaceous, often black-tipped spines, mixed with smaller setiform ones. *Ocrea* exsuccous, brittle. *Leaves* cirriferous, in one specimens 55 cm. long in pinniferous part, with a 20 cm. long, clawed cirrus, and a petiole about 8 cm. long; the latter armed with a few solitary spines; rachis armed at the sides and in the middle with a few simple claws, becoming digitate in the upper parts. *Leaflets* few, inequidistant, irregularly grouped, not divergent, 1–3 costate, unarmed on both surfaces, ending in a bristly tip; the largest 20 cm. long, and 12 mm. broad. *Male spadix* erect, shorter than the leaves, 40 cm. long, not cirriferous, unarmed, dividing into 3 primary branches (only one specimen seen); primary spathes unarmed, obliquely truncate at the apex. *Spikelets* 2–3 cm. long with a bifarious, alternately disposed, 6–8 flowers on each side; flowers 4 mm. long, calyx striate; corolla twice as long as calyx, polished.

MALAYA: Perak, Gunong Bubu, alt. circa 1900 m. (Wray 3,923).

Beccari reduced this species to *C. brevispadix*, which has subcirriferous leaves with leaflets arranged in distant groups of 4–6 each and armed on the three costae above. In the shape and disposition of leaflets, and the size of the leaves, the species appears

Tab. 29. *Calamus bubuensis (A–B: Wray 3,923—holotypus, ex Beccari).*
A, Folia cum vagina. B, Spadix masculus.

to be more like *C. Koribanus* which, however, has a filiform pendulous spadix, and leaflets which are occasionally armed in the midrib above. I have not seen the type specimen but have compared the material with the author's excellent plate of the type.

30. Calamus Koribanus Furtado **spec. nov.—t. 30.**

C. elegans Ridl. *sensu* Ridl. in Journ. F.M.S. Mus. IV (1909) 87 et Fl. Malay Pen. V (1925) 61 pro parte.

Inter species sectionis Phyllanthecti subsect. Cirruliferi haec species petiolis 25–40 cm. longis, fasciculis foliolorum distantibus irregulariter dispositis, spadicibus filiformibus plus minusve armatis, unguibus paucis brevissimis simplicibus, appendice spadicis terminali inermi floribus masculis approximatis pectinatis facile recognoscitur. A C. bubuensi, *cui frondium facie simillima, differt haec species spadicibus longioribus filiformibus pendulis etiam supra basin armatis.*

Caudex scandens, gracilis, 8–15 mm. in diam. *Vagina* osbcure geniculata, spinis triangularibus, valde inaequalibus, ad 1·5 cm. usque longis, solitariis in series irregulares interruptas approximatis praedita. *Frondes* cirriferae, in parte pinnifera 30–40 cm. vel interdum ad 75 cm. usque longae, in cirrum 20–50 cm. longum exeuntes; rachis unguibus simplicibus vel in parte ejus terminali digitatis armata, deciduo furfuracea; petiolus 25–35 cm. longus, secus margines et dorsum irregulariter armatus, in facie superiore inermis. *Foliola* per fasciculum 1–3, vix divergentia, lineari-lanceolata, subaequalia, 1–3 costata, utrinque inermia vel rarissime in facie superiore secus costam medianam et margine parcissime setosa 18–23 cm. longa, 12–18 mm. lata, fasciculis distantibus 6–10 cm. inter se remotis. *Spadix femineus* filiformis, longipedunculatus, parcissime aculeolatus, in appendicem brevem inermem exeuns, ad 25 cm. ultra metrum usque longus, in ramos 1–2 primarios, pendulos 10–25 cm. longos, divisus. *Spathae* primariae cylindricae aculeolatae, basales tantum bifaciales bicarinataeque; spathae secundariae ad 3 cm. usque longae, cylindricae, inermes, apice oblique truncatae, acuminatae. *Spiculae* 3–7 cm. longae; spathellae late infundibuliformes, striatae. *Involucrophorum* ad spathellae orificium oriens, cupuliforme; involucrum conforme. *Flores* in spicula utrinsecus 5–11, alternatae, 4–5 mm. longae; corolla apice striata, calyce striato duplo longior. *Perianthium fructiferum* subpedicelliforme, basi callosum. *Fructus* oblongus, 10–14 mm. longus, 8 mm. in diam., apice subito rostratus; squamis in 11–13 series dispositis, gramineis, secus margines atro-brunneis. *Semen* 8 mm. longum, 5 mm. latum, 3 mm. crassum; albumen aequabile; embryo lateralis. *Spadix masculus* femineo similis, sed ramis primariis longioribus, floribus minoribus magis approximatis pectinatis differt.

Stem scandent, 8–15 mm. in diam. *Leaf-sheaths* slightly geniculate, thickly armed with unequal, up to 1·5 cm. long spines. *Leaves* 30–40 cm. long, sometimes up to 75 cm. long in the pinniferous part, ending with a 20–50 cm. long cirrus; rachis clawed; petiole 25–35 cm. long, armed irregularly on the lower surface and on margins. *Leaflets* in distant fascicles of 1–3, not divergent, 1–3 costate, smooth on both surfaces, 18–23 cm. long, 12–18 mm. broad, subequal. *Female spadix* filiform, long aculeate, sometimes more than a metre long, often much shorter, divided into 1–2 primary branches. *Spathes*, primary and secondary cylindrical, the latter about 3 cm. long. *Spikelets* about 3–7 cm. long; spathels funnel-shaped, striate. *Involucrophore* and involucre

Tab. 30. *Calamus Koribanus (A–E: Henderson 18,017—holotypus: F–G: Henderson 23,380).*

A, Caudicis pars cum vaginis et spadice fructiferenti. B, Frondis fragmentum apicale. C, Fructus cum perianthio. D, Semen. E, Idem verticaliter discissum. F, Spadicis ramus masculi. G, Spicula mascula.

cupular; corolla striate at the apex, twice as long as the striate calyx. *Perianth* subpedicelliform. *Fruit* oblong 10–14 mm. long, 8 mm. in diam., abruptly beaked; scales yellow with dark brown margins arranged in 11–13 series. *Seed* with homogenous albumen; embryo lateral, nearly opposite to the chalazal fovea. *Male plant* like the female, except its leaflets are setose on the margins and on the median nerve above; the spadix and its branches more pedulous; flowers smaller and pectinate.

MALAYA: Pahang, Cameron's Highlands, alt. 1600 m. (Henderson 18,017–*Holotypus*, & 23,380; Wyatt-Smith 66,591); Telom (Ridley 13,920, male and female on the same sheet); Rhododendron Hill (Henderson 11,063 et 11,706).

Ridley (1909) used his Telom collection to correct his description of *C. elegans*, but not being part of the original syntypes of that species these have been excluded to form the basis of *C. Koribanus*. From the general aspect of the leaflets this species may be easily confused with *C. bubuensis*, which has, however, a short, unarmed, somewhat erect spadix, divided into shorter partial inflorescences. The male flowers are very closely packed, pectinate, not distant, alternate as in others.

This species has been named after Prof. Kwan Kohriba, Director of the Gardens during the Japanese occupation, who did much to protect the Botanic Gardens and Herbarium and the Raffles Museum and Library during the war.

31. Calamus brevispadix Ridl., Mat. Fl. Malayan Pen. II (1907) 207; Becc. in Ann. Roy. Bot. Gard. Calc. XI Suppl. (1913) 101 t. 57 excl. synon; Ridl., Fl. Mal. Pen. V (1925) 61 pp.— **t. 31.**

Stem slender, scandent, 1·5–2·5 cm. in diam. *Leaf-sheaths* obscurely geniculate or not, densely armed with unequal, nearly horizontal or slightly deflexed, somewhat sinuate, schistaceous or greenish brown, often black-tipped spines, sometimes approximate into short interrupted rows; the largest spines 2–3 cm. long, intermingled with smaller ones; at the mouth armed with large, porrect spines. *Ocrea* about 1·5 cm. long, exsuccous, brown, brittle, hispid and aculeolate. *Leaves* about 50–70 cm. in the pinniferous part, ending in an obscure, 15–25 cm. long, minutely clawed cirrus or in an odd narrow leaflet; petiole 12–35 cm. long, somewhat concave above, irregularly armed; those armed with digitate spines along the margins and the dorsum appear to be of the juvenile leaves, the armature gradually decreasing with age; the petiole in older plants armed with solitary spines along the margins and occasionally in the dorsum; rachis armed along the sides and the median with solitary claws, ternate in terminal parts. *Leaflets* lanceolate in irregular nearly opposite groups of 4–6 in each, not divergent, 1–3 costae (costae armed in the upper surface at least in the terminal half), smooth in the lower surface, setose on the margins; the mesial the largest, 25–30 cm. long, 15–23 mm. broad. *Male spadix* 40–70 cm. usually shorter than the leaves, bifaced and slightly armed at the base, otherwise unarmed even in the short terminal appendix; divided into 3–5 branches. *Primary spathes* exsuccous, membranous, loose in the upper parts, obliquely truncate-acuminate at the apex, only one in the

Tab. 31. *Calamus brevispadix (A–F: Ridley, paratypus: G–J: Burkill & Holttum 8,420).*

A, Frondis fragmentum mesiale. B, Spadix femineus. C, Spiculae fragmentum ut dispositio spathellae, involucrophori, involucri, floris feminei, et areolae appareat. D, Flos femineus. E, Fructus. F, Semen ejusdem verticaliter discissum. G, Petioli basis. H, Spadicis fragmentum masculi. I, Spiculae pars. J. Flos masculus.

peduncular part below the first branch. *Spikelets* on primary or secondary branches, 5–10 cm. long with bifarious, alternate, 4 mm. long flowers. *Female spadix* nearly similar to the male, shorter, 40–50 cm. long, divided into 3–4 fertile branches. *Spikelets* 3–4 on the primary branches, 5–8 cm. long, somewhat flexuose, with 6–12 alternate flowers on each side. *Secondary spathes* 1·5–2 cm. long, closely sheathing; spathels striate unilaterally infundibuliform, ligulate. *Involucrophore* adnate, slightly outside the mouth of the spathel, cupuliform. *Fruiting perianth* slightly callous at base, subpedicelliform. *Fruit* ovoid ellipsoid, narrowed on both sides, 10–12 mm. long (including the beak), 5–6 mm. though, with dark brown, concolorous scales in 12 series; embryo central and albumen homogeneous.

MALAYA: Selangor, Sempang (Ridley 15,879); Semangkok Pass, alt. 1300 m. (Ridley 12,121 holotype and s.n. collected at the same time, paratypes); Fraser Hill, alt. 1300–1500 m. (Burkill & Holttum 8,420 male, & 8,551 female).

C. brevispadix appears to be a very close ally of *C. Helferianus* which, I think, must be transferred to this subsection. In the holotype specimen of *C. brevispadix* in the Singapore herbarium there are no fruits on the spadix, and the one loose fruit mounted on the same sheet does not belong to it. However immature fruits are present in the paratype specimens.

I have excluded *C. bubuensis* from this species, because that species differs in many ways from this, specially in having a distinct cirrus to the leaves, and the leaflets being smooth on both surfaces. The specimen from Gunong Belumut, Johore, cited under this species by Ridley (1925) is of a quite unrelated species, named here as *C. belumutensis.* The duplicates of Ridley 15,879 bears 15,789.

32. Calamus benomensis Furtado **spec. nov.—t. 32.**

A C. bubuensi *foliolis ad basin magis approximatis, per gregem 3–6 dispositis, gregibus distantioribus, petiolis verisimiliter longioribus haec species differt. A* C. brevispadice *differt foliolis utrinque inermibus; squamis fructus bicoloribus, in series 13–15 dispositis.*

Caudex gracilis, scandens. *Frondes* longe petiolatae et cirriferae ut videtur; rachis secus margines et in dorsi medio unguibus simplicibus reflexis praedita. *Foliola* in fasciculis distantibus, 3–6 per fasciculum, disposita, paulo divergentia, 1–3 costata, utrinque inermia, linearioolanceolata, circa 25 cm. longa, 2 cm. lata. *Spadix femineus* erectiusculus, circa 35–40 cm. longus, ad basin tantum parcissime armatus vel non, in 3 ramos, 5–10 cm. longos, spiculiferentes divisus, in appendicem 9 cm. longam terminatus. *Spathae primariae:* basalis tantum bicarinata, alterae cylindricae, oblique truncatae; spathae secundariae conformes, ad 2 cm. usque longae; spathellae laeves, deciduo furfuraceae infundibuliformes, obscure apiculatae. *Involucrophorum* et involucrum cupuliformia. *Perianthium fructiferum* fere explanatum; corollae calycibus aequales, vel fere. *Fructus* immaturi ovato cuneati, valde rostrati; squamis gramineis secus margines atro-brunneis, per series 13–15 dispositis. *Spadix masculus* cum femineo simul collectus huic pertinet ut videtur, femineo similis, cum spiculis 5 cm. longis; flores 5 mm. longae, alternatae, in spicula utrinsecus 8–10; corolla calyce duplo longior.

Tab. 32. *Calamus benomensis (A–B: ♀ holotypus; C:paratypus simul collegitur).*

A, Frondis fragmentum mesiale. B, Spadix fructiferens. C, Spadix masculus.

Stem slender and climbing. *Leaves* apparently cirriferous and long petioled; rachis armed below with distant, simple claws. *Leaflets* disposed in distant groups of 3–6, linear-lanceolate, 1–3 costate, smooth on both surfaces, about 25 cm. long, 2 cm. broad. *Female spadix* about 40 cm. long, much smaller than the leaf, more or less erect, armed or not at base, divided in 3–4 spikelet-bearing branches, each 5–10 cm. long; spikelets up to 3 cm. long, with 4–5 bifarious, alternate flowers on each side. *Spathes* smooth, cylindrical, slightly bicarinate at base. *Perianth* almost explanate in the fruit. *Fruit* immature, ovate-cuneate, beaked, covered with yellow scales having dark brown margins and disposed in 13–15 series. *Male spadix* mounted on the same sheet, similar to the female, with longer branches and spikelets; male flowers 5 mm. long, 8–10 on each side, alternately disposed; corolla nearly twice as long as the calyx.

MALAYA: Pahang, Gunong Benom, ad alt. 1600 m. (legitur, s.n. a F.M.S. Musei Collectore, ad 28–VII–1935, in herb. Singaporense).

Though the specimens are incomplete, I have ventured to name the species in order to show the differences between this and *C. brevispadix* and *C. bubuensis*, and also because there is a great deal of confusion among the species of this subsection. *C. benomensis* appears to be a much larger plant than both the above named species and to bear a cirrus to the leaf, which is wanting in *C. brevispadix*; the last mentioned has, moreover, leaflets which are setose on the 3 costae above. *C. bubuensis* is a much smaller species belonging to this subsection, but was referred to *C. brevispadix* by Beccari.

V. Sectio PLATYSPATHUS Griff. **emend.** Furtado

Platyspathus (vel Platyspathae, Platyspatha vel Platyspathes) Griff. in Calc. Journ. Nat. Hist. V (1845) 73 et 78, in Palms Brit. Ind. (1850) 8, 36, 83, et XXI: (Platyspathae) Drude in Engl. u. Prantl, Pflanzenf. II. 3 (1887) 52; Baill., Mon. Palm (1895) 260: omnino pro parte.

Mischanthectae Ridl., Mat. Fl. Pen. II (1907) 189 et Fl. Mal. Pen. V (1925) 49 partim.

Plantae scandentes vel non, non-scandentibus exceptis, flagelliferae. *Frondes* ecirriferae, cum foliolis ensiformibus, vel ellipticis. *Spadices* ex plantis scandentibus flagelliformibus, interdum longe-appendiculati. *Spathae primariae* basi tantum stricte tubulares, apicem versus laminares vel loriformes, interdum laceratae vel fissae. *Spiculae* sessiles. *Involucrophora* sessilia.

DISTRIBUTIO: Indo-Malaya ex Bengalia et Assamia usque ad Malayam, Sumatram et Borneo.

LECTOTYPUS: *C. platyspathus.*

Griffith adopted both singular and plural forms for his sectional names. As defined by Griffith this section included *C. leptopus* which is a true Daemonorops, as well as *C. Rheedei* which belongs to the new section *Macropodus* characterized by having sessile spikelets and stalked involucrophores.

The species of the section *Platyspathus*, as restricted here, produce non-cirrate leaves and tubular-based primary spathes having strap-shaped or loriform limbs that split longitudinally or tear off irregularly in the course of their development; both the spikelets and the involucrophores of the species of this section are sessile. The section includes Beccari's Group IIA and VI. Some of the species like *C. arborescens* and *C. longisetus*, which belong to Beccari's Group IIA, have large flowers and fruits. In *C. longisetus* the fruit scales are not channelled, such as are found in the genus Cornera; but the spadices with its spikelets are long, usually pendulous, not short with congested spikelets. Further the flowers are bifarious, not secund or subsecund as in Cornera where the spathes, though with ear-shaped apices, neither disintegrate, nor split.

Key to the Species

(A) Leaflets ensiform, 3–5 cm. broad, unicostate, not longitudinally plicate.

(a) Leaflets equidistant (not fascicled), whitish beneath. Leaf-rachis armed on the dorsal side with long, flat, triangular spines arranged in oblique rows. Stem erect. Fruit scales channelled with scariose margins.

C. arborescens Griff.

(aa) Leaflets inequidistant, often arranged in distinct groups, not whitish beneath. Leaf-rachis armed with short solitary claws. Stem climbing. Fruit scales not or slightly channelled, conspicuously fringed at apex.

C. longisetus Griff.

(AA) Leaflets, when ensiform less than 3 cm. broad; when broader, elliptic lanceolate, pluricostulate, longitudinally plicate.

(B) Leaflets broadly elliptic-lanceolate, pluricostulate, more than 3 cm. broad.

(b) Stem climbing. Leaf-sheaths flagelliferous, armed with flat, triangular, 8–20 mm. long spines scattered among many smaller, sometimes minute spines. Leaflets often whitish beneath. Apical leaflets somewhat united at base, porrect. Spadix flagelliform with clawed internodes.

C. myrianthus Becc.

(bb) Stems erect. Leaf-sheaths non-flagelliferous, armed irregularly with spines varying in length, some at the petiole base being up to 7 cm. long. Leaves imparipinnate, or ending in two entirely free, somewhat divaricate leaflets. Leaflets not whitish beneath. Spadix short, not clawed.

C. ramosissimus Griff.

(BB) Leaflets ensiform, 3 cm. or less broad, 1–3 costate.

(c) Leaflets less than 15 mm. broad, many closely set, equidistant. Stems climbing. Spadix flagelliform, strongly clawed. Some of the spines on the leaf-sheaths broadly triangular.

(d) Petiole geniculate.

(e) Leaf-sheaths armed with large, flat triangular lanceolate spines about 2–2.5 cm. long, scattered among such smaller spines. Apical leaflets slightly connate at base. Leaf-rachis smooth. Secondary spathes and spathels not armed. Seeds roundish.

C. multirameus Ridl.

(ee) Leaf-sheaths armed with large sub-equal spines, all more or less concave beneath. Apical leaflets free to the base. Leaf-rachis thickly furfuraceous. Seeds similar to an impression of a horsehoof.

C. paspalanthus Becc.

(dd) Petiole non-geniculate.

C. perakensis var. **gracilis** Furtado.

(cc) Leaflets 1.5–3 cm. broad, remote or inequidistant. Stems climbing or not; spadix short or long, not clawed or with a few claws. Leaf-sheath spines not broadly triangular.

(f) Stems short, erect or semi-scandent. Spadix smaller than the leaf. Female spikelets 3–6 cm. long. (Rarely leaflets more narrow or nearly equidistant).

C. perakensis Becc.

(ff) Stem scandent. Spadix very long, much longer than the leaf. Female spikelets 6–15 cm. long.

C. laxissimus Ridl.

ENUMERATION OF SPECIES

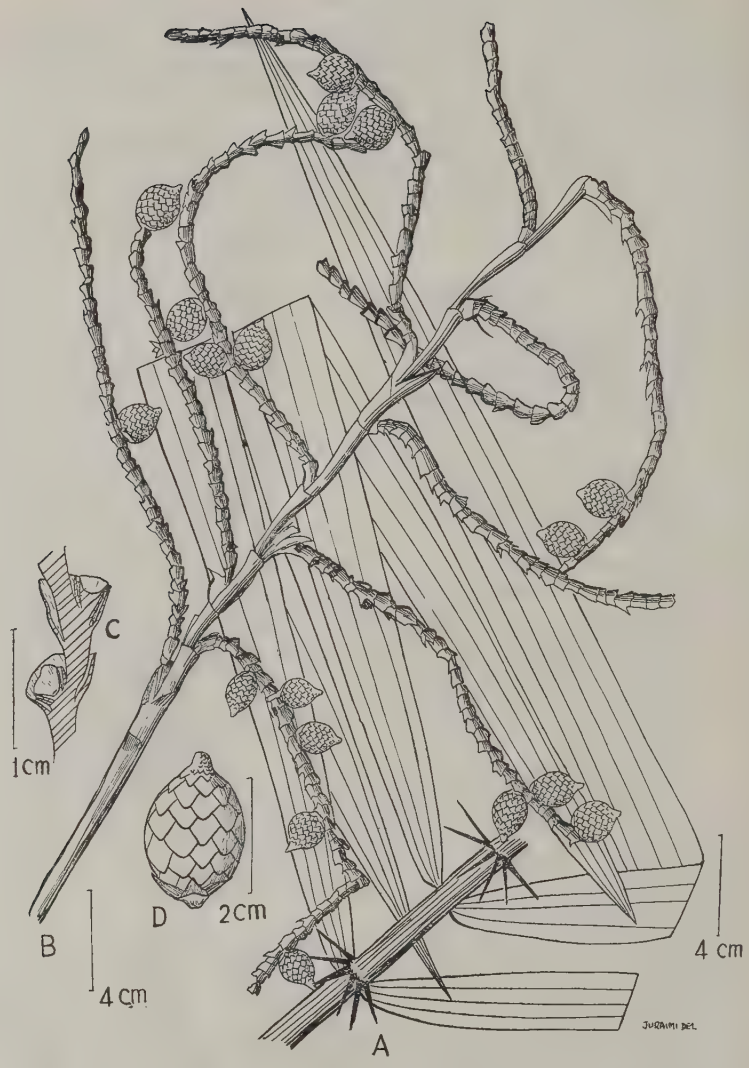
33. Calamus arborescens Griff. in Calc. Journ. Nat. Hist. V (1844) 33 et Palms Brit. Ind. (1850) 42 t. 188 A & B (sphalm. *C. arboraceus*) et C; Mart., Hist. Nat. Palm. III (1850) 332; Kurz in Journ. Asiat. Soc. Bengal XLIII pt. 2 (1874) 209 t. 22 et For. Fl. Burma II (1877) 516; Becc. et Hook. f., Fl. Brit. Ind. VI (1892) 439; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 131 t. 7; Ridl., in Journ. Roy. Asiat. Soc. Straits Br. LIX (1911) 215 et Fl. Malay Pen. V (1925) 64 pro parte.—**t.t. 33 & 33a.**

Stem tufted, erect, 4–6 m. high, and 6–8 cm. in diam. *Leaf-sheaths* (like petiole and leaf-rachis) armed with large, flat, black, triangular, seriate spines. *Leaves* up to 5 m. long including the 0·5 to 1·5 m. long petiole; the latter armed with black elastic, confluent spines up to 7–8 cm. long; rachis similarly armed with confluent black spines which become smaller and more slender in the terminal portions of the rachis. *Leaflets* numerous, equidistant, broadly ensiform, up to 1 m. long, 3–5·5 cm. wide, whitish beneath. *Spadices* not flagelliform, much shorter than the leaves; primary spathes tubular in the lower part, lacerated in the upper, armed with needle-like black spines; secondary spathes tubular with subinflated and lacerated limbs. *Spikelets* about 15–25 cm. long. *Fruit* large, elliptic, 20–22 mm. long, 14–15 mm. broad; scales reddish brown, channelled in the middle, with a darkish intramarginal line; seed with homogeneous albumen.

MALAYA: Setul, Bukit Rajah Wang (Ridley, 15,358 male and female specimens).

DISTRIBUTION: Burma.

Ridley confused with this species some specimens of *C. longisetus*. The holotype specimen was derived from a plant obtained from Pegu, Burma, and cultivated in Botanic Gardens, Calcutta, under the name of *C. hostilis*. Beccari's plate 7 was derived from a plant belonging probably to the clump numbered XII.C.139 in the Botanic Gardens, Bogor, Java, the same clump which later supplied the specimens distributed by me under Singapore Field No. 30,804. This clump was recorded to have come from seeds obtained in the jungles of Menado, Celebes, but this is obviously in error.



Tab. 33. *Calamus arborescens (Ridley 15,358 ♀).*

A, Folii pars mesialis. B, Spadicis ramus spiciferens. C, Pars spiculae verticaliter discissa ut dispositio spathellae, involucrophori et involucri appareat. D, Fructus.

Tab. 33a. *Calamus arborescens (Ridley 15,358 ♂).*
A, Petioli fragmentum. B, Apex plantae juvenilis cum folio. C, Spadicis ramus spiculiferens. D, Flos masculus.

The plant is tufted, but the individual stems in the clump grow at some distance from each other showing that the branches grow at first horizontally in the ground.

34. Calamus longisetus Griff. in Calc. Journ. Nat. Hist. V (1845) 36 et Palms Brit. Ind. (1850) 44 t. 189 A & B; Mart., Hist. Nat. Palm. III (1850) 333; Becc. et Hook. f., Fl. Brit. Ind. VI (1892) 440; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 134 t. 9; Furtado in Gard. Bull. Straits Settl. VIII (1935) 253. —**tt. 34 & 34a.**

C. arborescens Griff. *sensu* Ridl., Journ. Roy. Asiat. Soc. Straits Br. LIX (1911) 215 et Fl. Malay Pen. V (1925) 64 quoad specimen lankawiense.

C. tigrinus Kurz in Journ. Asiat. Soc. Bengal XLIII pt. 2 (1874) 211 t. XXV & XXVI & For. Fl. Brit. Burma II (1877) 519.

Stem large, tufted, scandent, with sheaths 5–8 cm. in diam. *Leaf-sheaths* flagelliferous (?), armed strongly with whorls and half-whorls of broad, flat, triangular spines. *Leaves* large, 2–4 m. long; petiole very long armed with spines similar to those of the sheaths, scattered or variously aggregated in complete or partial whorls; rachis armed with strong, solitary deflexed claws, at least in the upper half of the leaf. *Leaflets* inequidistant, often in groups of 2–3 in the basal portions, subequidistant towards the summit, concolorous (not glaucescent beneath), ensiform, unicostate, the largest 50–60 cm., 3·5–5 cm. broad. *Spadix* very long, flagelliform, decompound, with a few, 50–70 cm. long branches; spikelets up to 20 cm. in the female spadix, shorter in the male where the spikelets are tertiary branches. *Primary spathes* tubular with lacerated, decayed upper parts, armed with strong claws; secondary spathes unarmed, marcessent and lacerate in the upper parts of the female spadix seen. *Fruit* 30–33 mm. long, 15–20 mm. in diam.; scales not channelled along the middle, somewhat blackish in the centre, conspicuously fringed in the margin; seed with equable albumen.

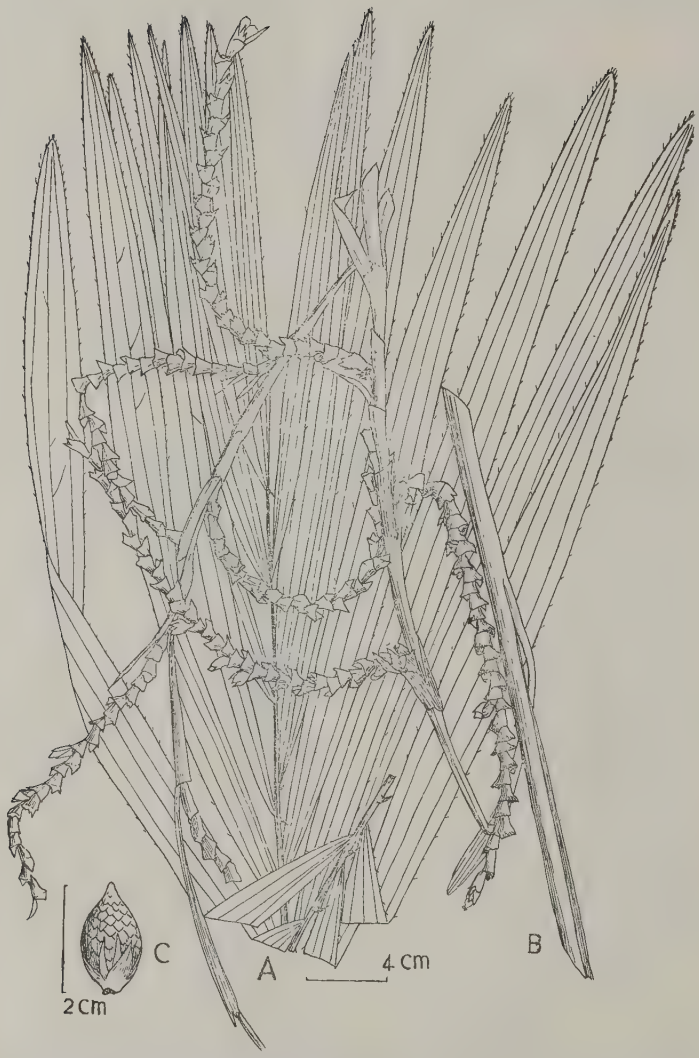
MALAYA: Langkawi, Gunong Raya (Haniff 15,910); loc. incert. (Haniff in IX–1900).

DISTRIBUTION: Burma and Andamans.

I have seen some fragments of leaves, and of male and female partial inflorescences, the last with a few small fruits. I have followed Beccari for the description given here of the stem, leaf-sheaths, petioles and the seed.

There are no reasons to doubt the identity of Malayan specimens with Beccari's plate 9; but whether they are also identical with *C. longisetus* as depicted by Griffith or with *C. tigrinus* as depicted by Kurz, I am not in a position to say. Both Griffith's and Kurz's plates show a good deal of difference especially in the armature of the lower-half of the leaf-rachis and the petiole; and I have seen neither the petiole, nor the leaf-sheaths of the Malayan

Tab. 34. *Calamus longisetus (Haniff in 1900 ♂).*
A, Folii fragmentum. B, Spadicis fragmentum. C, Flos masculus.



Tab. 34a. *Calamus longisetus (Haniff 15,910 ♀).*
A, Folii fragmentum apicale. B, Spadicis pars. C, Fructus cum perianthio.

species, nor do I know the range of variation in the species. Beccari, however, had the advantage of examining the types and comparing them with very good specimens from Andamans; and his conclusion was that the Andaman species and *C. longisetus* and *C. tigrinus* were all identical. The petiole illustrated by Beccari in t. 9 is from the Andamans and is armed somewhat differently from that figured by Griffith; neither the petiole nor the topmost of the rachis seen in the Malayan specimens bear flat spines as seen in *C. arborescens* and as drawn by Griffith for *C. longisetus*. It is also possible that the leaf-specimen figured by Griffith is basal. The fruit scales are not channelled as in the fruits of Corner species, and the flowers and fruits are large.

In the Andamans the fruits are said to be eaten cooked and the leaflets are used for thatch.

35. Calamus myrianthus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 451 et in Ann. Roy. Bot. Gard. Calc. XI (1908) 306 t. 118.—**t. 35.**

C. leucotes Becc. in Ann. cit. p. 309 t. 120. **syn. nov.**

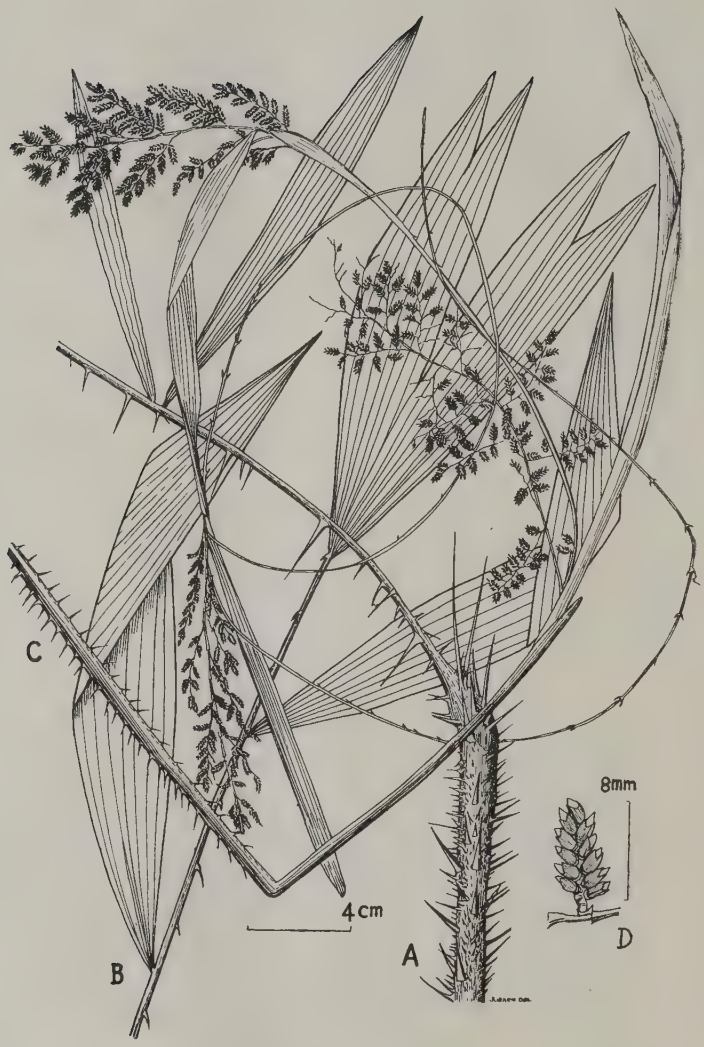
C. hypoleucus (Kurz) Kurz, Fl. Brit. Burma II (1877) 532, male spadix only.

Daemonorops hypoleucus Kurz in Journ. Asiat. Soc. Bengal XLIII pt. 2 (1874) 208 quoad t. XIX tantum.

Stem scandent, 3–4 m. long, with sheaths 1·5–2·5 cm. in diam. *Leaf-sheaths* gibbous below the petiole, armed with solitary, flat, triangular, subulate, ascendent, 2–3 cm. long spines which are scattered among many much smaller but similar shaped spines; the spines at the mouth of the sheath much longer, up to 6 cm. long. *Ocrea* obscure in the older leaves, apparently long, papery, unarmed, marcescent and deciduous in young. *Leaves* (not seen entire); petiole 7–14 cm. or more long, armed along the dorsum and sides with scattered solitary spines, some up to 2·5 cm. long, others much shorter, the dorsal spines being usually the longest. *Leaflets* inequidistant, remote, 10 cm. or more apart, sometimes approximate in twos, multicostate, lanceolate, alternate or subopposite, 45 cm. long, 4–6 cm. broad, longitudinally plicate, with ashy-grey or whitish under-surface; the basal leaflets the shortest; the two terminal leaflets slightly united at the base, sometimes for nearly one-third in length. *Spadix* (male only seen) flagelliform, ultradecompound, slender, with 15–35 cm. long, cupressiform branches. *Primary spathes* with a long strap-shaped limb.

MALAYA: Lower Siam, Wa Sa Uhm in Surat (Seidenfaden 2,251, vern. nom. *Gikai*); loc. incert. (Hamid 3,776, vern. nom. *Wai Kekai*); Kasom (Curtis 3,248); Kopah at Janjan (Haniff and Nur 2,056).

DISTRIBUTION: Tenassirim in Lower Burma.



Tab. 35. *Calamus myrianthus (Curtis 3,248 ♂).*

A, Frondis vagina cum petiolo. B, Frondis fragmentum apicale. C, Spadix masculus. D, Spicula ut florum dispositio appareat.

There is a good deal of variation in the armature of the leaf-sheaths and the mealiness of the lower-surface of the leaflets depending upon the age of the plants and the environment.

The types of both *C. myrianthus* and *C. leucotes* were from Tenasserim. The Kopah specimen (Haniff and Nur 2,056) has leaf-sheaths and spathes exactly as in the type of *C. leucotes*. In the Kasom specimens, which come from an apparently weak plant, the leaf-sheaths and the basal primary spathes are very much less armed.

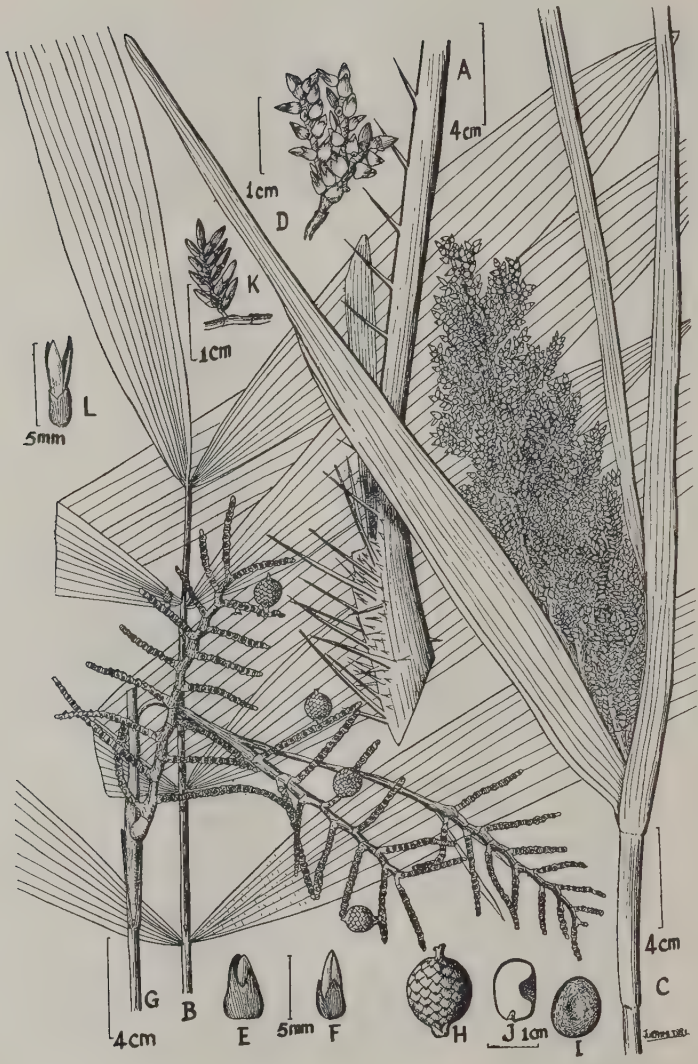
36. Calamus ramosissimus Griff. in Calc. Journ. Nat. Hist. V (1845) 78 et Palms Brit. Ind. (1850) 87 t. 207; Becc. and Hook. f., Fl. Brit. Ind. VI (1893) 450; Ridl., Mat. Fl. Malayan Pen. II (1907) 201; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 202 tt. 109 and 110; Ridl., Fl. Malay Pen. V (1925) 58.—**t. 36.**

Daemonorops ramosissimus (Griff.) Mart. Hist. Nat. Palm III (1850) 330.

Stem solitary, short, erect or subscandent, 1–4 m. tall deciduously ferrugineous in most parts. *Leaf-sheaths* open on the ventral side, armed at the mouth with up to 6 cm. long spines, and on the dorsal side with a few or many solitary reddish spines. *Leaves* 3–4 m. long including 45 cm. to 100 m. long petiole; rachis clawed. *Leaflets* numerous, remote, subequidistant, lanceolate, brownish, multi-costulate, plicate, 35–40 cm. long, 5–6 cm. broad, 6–10 cm. apart. *Spadices* erect, 40–80 cm. long; female spikelets borne on primary branches; male decompound. *Primary spathes* with broad strap-shaped limb, unarmed, except occasionally the basal one. *Fruit* ovoid, beaked, 13–14 mm. long, 8–10 mm. broad; scales reddish with intra-marginal darkish lines, arranged in 15 longitudinal series; seed with equable albumen.

MALAYA: Trengganu, Ulu Brang, alt. ± 800–1,000 m. (Kiah & Moysey 33,394 & 33,629); Brang at Tersat alt. ± 800 (Kiah & Moysey 33,396). **Kelantan,** Sungai Keteh (Nur with Foxworthy 11,961). **Kedah,** Kedah Peak (Ridley VI–1893); Serdang (Spare 3,738 male and female). **Kemaman,** Sungai Nipah, low alt. (Corner 30,522). **Pahang,** Sungai Tahan at Kuala Tenok (Ridley in 1891); **Perak,** Gunong Chantek at Gopeng (Furtado 33,083); Taiping Hills (Ridley 11,986; Haniff and Nur 2,499); Maxwells Hill, alt. 1,000 m. (Burkill and Haniff 12,688); Bujong Malacca (Ridley 9,809); Tea Gardens in Taiping, alt. 1,000–1,600 m. (Curtis in IX–1889); Larut Hills, alt. 1,000 m. (Curtis 25–XII–1901); Pondok Tanjong (Burkill and Haniff 13,239); Gunong Keledang (Ridley X–1898). **Selangor,** Sungai Lalang in Kajang (Symington 22,885); Semeniyh (Hume 7,963); Ginting Simpah (Hume 9,591). **Negri Sembilan,** Ulu Rembau alt. 300 m. (Nur 11,766); Gunong Angsi, alt. 800 m. (Nur 11,574; Ridley in II–1904); Ulu Bendol (Holttum 9,882).

The species was described by Griffith from specimens which probably had been collected in Malacca. The leaves terminate either in two or in three entirely free leaflets.



Tab. 36. *Calamus ramosissimus (A–F: Nur 11,574; G–I: Burkill & Haniff 12,688; K–L: Holttum 9,882).*

A, Petioli pars basalis. B, Folii fragmentum apicale. C, Spadix femineus. D, Spiculae. E, Flos femineus. F, Flos ejus acolytus. G, Spadicis pars fructiferentis. H, Fructus. I, Semen. J, Idem verticaliter discissum. K, Spicula mascula. L, Flos masculus.

37. Calamus multirameus Ridl. (multiramea), Mat. Fl. Malay Pen. II (1907) 202 pro parte (ex altera parte = *C. concinnus*).—**t. 37.**

C. concinnus Mart. *sensu* Ridl., Fl. Malay Pen. V (1925) 59 pro parte.

C. Guruba Ham. *sensu* Becc. in Ann. Roy. Bot. Gard. Calc. XI Appendix (1913) 49 quoad specimen perakense, haud in observ. sub. *C. perakense* p. 48.

Stem slender, scandent, with sheaths 1–2·5 cm. in diam. *Leaf-sheaths* gibbous below the petiole, armed with flat, triangular, often slightly oblique, solitary, ascendent, 1–2·5 cm. long spines, scattered among many similar but much smaller, sometimes minute spines, and with longer but narrower, 6–12 cm. long spines at the mouth of the sheath, and, therefore, at the base of the petiole. *Leaves* 60–75 cm. long, including the 10–15 cm. long petiole; this is armed on the lower surface of the basal half and in the geniculum with many small spines interspersed with larger, 5–8 mm. long claws along the margins and the median line of the dorsum, the claws being present also in the leaf-rachis. *Leaflets* numerous, closely set, equidistant, 2–3 cm. apart, narrowly ensiform, with long, subulately acuminate apices, setose on the upper half of the lower surface along the 3–5 costae, in the upper surface setose only on the median costa, 20–28 cm. long, 10–15 mm. wide; the two apical leaflets slightly connate at the base. *Spadix* flagelliform; the peduncular part armed with many unequal ascendent spines up to 15 mm. long. *Primary spathes* longitudinally split, loriform, in the male spadix coriaceous straw-coloured, and persistent, and in female spadix marcescent and deciduous; the basal spathe densely armed, the others unarmed or nearly so. *Fruit* sphaeric, 7–9 mm. in diam., beaked; scales light yellow, with a brown intramarginal line, channelled in the middle, arranged in 15–18 longitudinal series; seeds with an equable albumen.

MALAYA: Perak, Dindings (Ridley 8,405 partly, syntype). **Pahang,** Kuala Luit (Ridley in 1891, syntype); Sungai Chenik (Burn-Murdoch 193, vern. nom. *Rotan Sabot*).

Beccari (1913), after examining the above quoted syntypes of *C. multirameus*, reduced it to *C. Guruba*, a species which has a wide distribution in Bengal, Assam, Shilet, Burma and Cochin-China. I have separated *C. multirameus* from *C. Guruba* because in the latter the three costae on the upper surface of the leaflets and usually the midcosta on the lower surface and exceptionally lower side nerves also, are bristly, whereas in *C. multirameus* the 3–5 costae are bristly on the lower surface, the midcosta being alone bristly in the upper surface. Further in *C. Guruba* the leaf-sheaths, the geniculum, the petiole, and the basal primary spathes of the male spadix are less armed, the two apical leaflets are more connate, and only one long spine develops on each side of the petiole base. In the shape of the leaflets, *C. multirameus* appears more like *C. nitidus*, but the leaflets in the latter have 5 bristly costae in the upper surface. The leaf-sheath and the petiole of *C. nitidus* are not known.

Tab. 37. *Calamus multirameus (Burn-Murdoch 193 ♀ & ♂).*

A, Caudicis fragmentum ut vaginae armatura appareat. B, Frondis fragmentum apicale. C, Spadicis pars masculi. D, Fragmentum spadicis feminei.

From the description given by Beccari (1908), *C. Guruba*, appears to vary a good deal in many characters, and possibly *C. multirameus* and *C. nitidus* might have to be reduced as varieties of *C. Guruba.*

C. concinnus, with which *C. multirameus* has been confused by Ridley (1925), is totally unlike the latter and belongs to Beccari's Group V and to my subsection *Coleospathus*, whereas *C. multirameus*, like *C. perakensis*, belongs to Beccari's Group VI and to the section *Platyspathus*. However on Ridley 8,405 (syntype of *C. multirameus*) there is mounted a fruiting branch of *C. concinnus*, a fact pointed out by Beccari (1913 p. 49); this is probably a reason why Ridley reduced his entire *C. multirameus* to *C. concinnus.*

The female spadix with young fruits in Ridley 12,116 (syntype of *C. lanatus*) is not *C. multirameus* as interpreted here, but of a form of *C. perakensis.* Beccari (1913 p. 48), misled by the hooked axis of the spadix and somewhat distant fruits, quoted the specimen under *C. Guruba.* The primary spathes in the specimen are not marcescent and deciduous and the fruiting scales not light yellow, characters not found in *C. Guruba* or *C. multirameus.*

38. Calamus paspalanthus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 450; Ridl., Mat. Fl. Malayan Pen. II (1907) 200; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 295 t. 112, et Appendix (1913) 48; Ridl., Fl. Malay Pen. V (1925) 55.—**t. 38.**

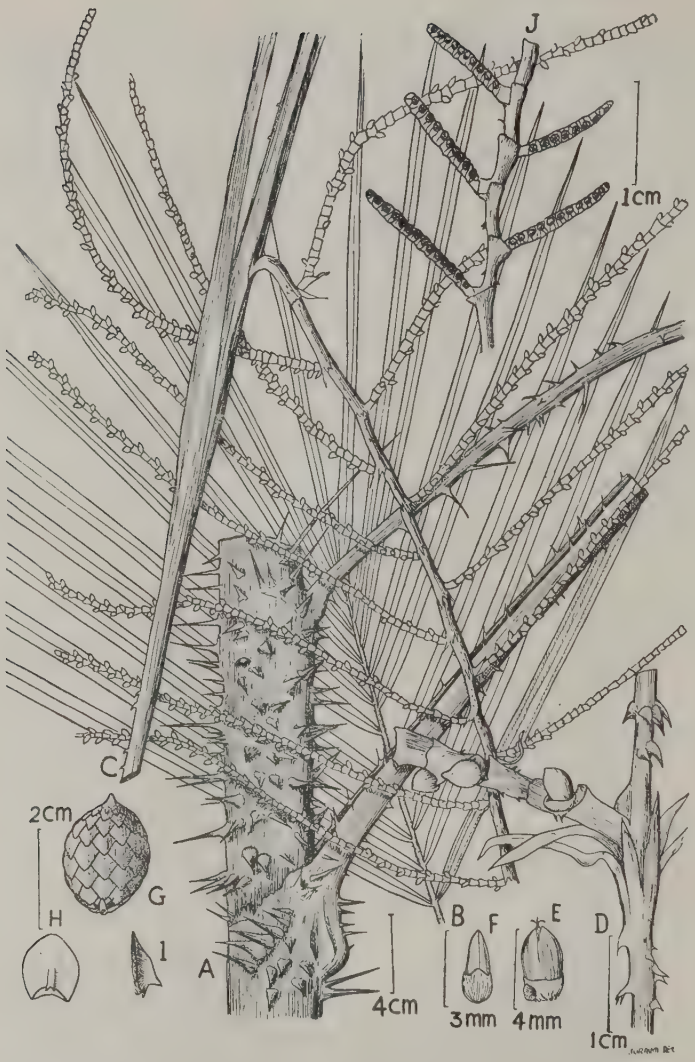
C. paspalanthus Becc. var. *peninsularis* Becc. in Ann. *cit.* (1908) 298 tt. 111 and 113 et Appendix (1913) 48, **syn. nov.**

C. paspalanthus Becc. var. *pterospermus* Becc. in Engl. Bot. Jarhb. XLVIII (1912) 91 et Annals *cit.* Appendix (1913) 48 t. 26, **syn. nov.**

C. intumescens (Becc.) Ridl., Mat. cit. II (1907) 200.

Daemonorops ? *intumescens* Becc. in Rec. Bot. Surv. II (1902) 222.

Stem solitary, scandent, 15–20 m. long, with sheaths 2·5–5 cm. in diam. *Leaf-sheaths* darkish, conspicuously tumescent at the petiole base, armed with triangular, solitary, ascendent, mostly subequal, about 3 cm. long spines (6–10 cm. long along the apical margin), having tumescent, sometimes confluent bases. *Ocrea* over 30 cm. long, papyraceous, soon marcescent, deciduous. *Leaves* 2·5–3·5 m. long, including the 45–80 cm. long petiole; the latter deeply channelled above, armed below along the margins and the dorsal median with short, up to 1 cm. long spines, provided on both surfaces with deciduous indumentum; rachis armed with 3-fid claws beneath, and clothed more especially on the upper surface with deciduous brownish indumentum. *Leaflets* narrow-ensiform, equidistant, closely set, 1·5–2·5 cm. apart, subequal, 30–40 cm. long, 8–15 mm. broad, the terminal two quite free. *Spadix* flagelliform, strongly clawed, deciduously ferrugineous all



Tab. 38. *Calamus paspalanthus (A–I: Corner 30,875; J: Ridley 11,209).*

A, Caudicis pars. B, Frondis fragmentum apicale. C, Spadicis pars feminei. D, Ejusdem fragmentum auctum ut spathellae et florum dispositio appareant. E, Flos femineus cum involucro ut areola appareat. F, Flos acolytus. G, Fructus. H, Semen ambitu equinae ungulae fere simile. I, Imago seminis obliqua. J, Spadicis fragmentum masculi perauctum ut spiculae et involucrorum et spathellarum dispositio appareant.

over, 3–5 m. long, with 20–70 cm. long branches; female spikelets subequal in a branch, 15–25 cm. long, 3–4 cm. apart, alternate; male shorter with pectinate flowers. *Primary spathes* lacerate and unarmed or slightly armed in the upper parts; secondary spathes terminating in a long lacerate, decaying point, often armed at the middle especially in the robust, female spadices; spathels in female spadices often armed at the middle. *Fruit* very broadly ovate or elliptic, beaked, 18–22 mm. long, 10–12 mm. in diam.; scales arranged in 15–18 series, brown, with darker intramarginal lines. *Seed* very anomalous in shape in the genus, bifaced, more or less horse-hoof shaped, emarginate and thickened at the base, flat on one side, convex on the other or sometimes surmounted with a truncate-edged apex; albumen equable.

MALAYA: Johore, Serom (Ridley 11,213); Batu Pahat (Ridley 11,209); Sungai Pelepah (Nur 20,043); Ulu Segun on Gunong Panti, alt. circa 100 m. (Corner 30,875, vern. nom. *Rotan Batu*); Sungai Kayu (Kiah 32,387).

BORNEO: Sarawak, loc. incert. (Hewitt in 1908); Kuching (Ridley in VII–1903); Beram (Hewitt in IV–1907); Jambusan (Ridley 12,403, male and female).

There is a good deal of variation in this species so that it is not easy to distinguish the different varieties created by Beccari. Even in fruit there are some variations which are midway the extreme forms. The armature of spathels and of leaf-sheaths also varies a good deal, depending upon the vigour, the stage of the development and the age of the plants, and perhaps also on the position of the organ. The type form and the var. *pterospermus* was based on the specimens collected respectively in North Borneo (Sarawak) and South Borneo, while the Malayan specimens were referred to var. *peninsularis.*

According to Beccari the spathels in the female spadix, the var. *typicus* and var. *pterospermus* are unarmed, but in all the specimens I have seen even in Ridley 12,403 from Jambusan (Borneo), the spathels are aculeolate and the scales of the fruit are in 15–16 series; and Beccari has identified the last mentioned specimen as belonging to the type form of the species which are described to bear fruit scales in 18 series. In Ridley 11,213 from Johore (Malaya) the spathes in some spikelets are unarmed and others have a few sometimes not fully developed spines; the seeds have not reached their definitive stage so that it is not easy to say in which category the seed falls. However Kiah 32,387 and Nur 20,043 have more or less similar spadices and spathes, and the seed has the shape described for the var. *pterospermus.* On the other hand Corner 30,875, although it has the fruit scales in 15 series and the spathels more or less armed, has the seed which is of the shape described for the var. *typicus.* A further study in the field is necessary to clarify the status of these variations.

Ridley 10,780 from Bukit Timah, Singapore, cited by Ridley under *C. intumescens* in the *Materials* (1907) and under *C. paspalanthus* in the *Flora* (1925), consists of some young spathes

and of bits of male spadix branches neither of which could be identified with certainty. Apparently the material was collected from a dead plant.

39. Calamus perakensis Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 451; Ridl., Mat. Fl. Mal. Pen. II (1907) 202; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 290 t. 108 et Appendix (1913) 47; Ridl., Fl. Mal. Pen. V (1925) 58.—**t. 39.**

C. Guruba Ham. *sensu* Becc. Ann. Appendix cit. (1913) 47 sub observ. *C. perakensis.*

C. lanatus Ridl. (*lanata*), Mat. cit. II (1907) 202.

C. perakensis var. *lanatus* (*lanata*) (Ridl.) Ridl., Fl. cit. V (1925) 59 partim. **syn. nov.**

Stem tufted, erect at first, later semi-scandent, about 4–6 m. long, slender; young parts deciduously rusty. *Leaf-sheaths* non-flagelliferous, open on the ventral side, often provided with up to 15 cm. long porrect spines along the margins at the base of the petiole, practically unarmed on the dorsal side or densely armed with solitary, unequal brownish spines. *Leaves* variable in size depending upon the growth of the plant, the longest about 2·20 m. long, including the petiole; the latter as long as 80 cm. in some specimens and armed with patent spines on both sizes, sometimes also on the central side, obscurely geniculate in the older plants; rachis armed with 1–3 series of simple spines, digitate by confluence in the lower portions, and by 1 series or more of simple or digitate spines in the upper regions, or by spines arranged in a mixture of these two series. *Leaflets* brownish, numerous, ensiform, equidistant, closely set, alternate or opposite, usually porrect (or in later (?) leaves in distant pairs, 3–9 cm. apart, exactly opposite or sub-opposite, patent or somewhat reflexed) the largest 25–30 cm. long, 2–25 mm. wide. *Spadix* short in younger plants, longer later, erect or bent in the upper parts, 3–6 branched, long peduncled, the axis in later spadices sometimes clawed but without a flagelliform appendix; male branch often twice divided; female spikelets borne directly on the primary branches. *Primary spathes* long, often unarmed, but sometimes sparsely armed, tubular but with a long split apex, brownish. *Fruiting perianth* sub-callous at the base, split nearly to the base. *Fruit* globose, with beaked apex; scales brown, with a dark intramarginal line, arranged in 18 series; albumen equable.

MALAYA: Trengganu, Gunong Padang, alt. ± 1,100 m. (Kiah & Moysey 31,802; Hislop in VII–1952). **Kemaman,** Ulu Bendong at Kajang, ± 150–200 m. alt. (Corner 30,096; 30,097; 30,508; 30,515, & 30,516). **Kelantan,** Sungai Keteh (Henderson 19,641, as *Rotan Semado*). **Perak,** Bukit Kapayung (Ridley in II–1904 spadix only, leaf = *Ceratolobus laevigatus*); Gunong Batu Puteh, Lower Camp ± 1,100 m. alt. (Wray 454, distributed as *C. castaneus* ?). **Pahang,** Fraser Hill, ± 1,200–1,400 m. alt. (Burkill & Holttum sn.; 7,757 & 8,421; Nur 10,514); Sungai Lemoi (Dolman 28,159 as *Rotan Dudok*); Sempadan at Gap (Burn-Murdoch comm. sub. num. Ridley 13,301, as (*Rotan*) *Chuchok Baok*); Gunong Tapis in Kuantan, ± 1,200 m. alt. (Symington & Kiah 28,871); Telow (Ridley 13,922); Gunong Tahan (Wray & Robinson 5,427 partim spadix). **Selangor,** Semangko Pass, 1,200 m. (Ridley sn., ♂, & 12,116 ♀, syntypes of *C. lanata*); Ginting Simpah (Hume 9,666); Bukit Hitam (Ridley 7,879); Bukit Kutu (Ridley on 2–VI–1896). **Johore,** Gunong Belumut (Holttum 10,786); Sungai Semandan at Jason Bay (Corner 28,539); Mersing (Corner 32,234).

Tab. 39. *Calamus perakensis (A–C: Corner 30,508 ♀; D–G: Burkill & Holttum 8,421; H: Ridley 13,922 ♂).*

A, Petiolus cum basi folii laminari. B, Frondis fragmentum apicale. C, Spadix femineus. D, Spadicis pars cum fructibus. E, Fructus. F, Semen. G, Idem verticaliter discissum, H, Spadicis fragmentum masculi.

There is a good deal of variation in this species and unless the full range is known, it would be inexpedient to establish varieties. The plant seems to flower when very young and, being tufted, the collectors apparently prefer to gather the specimens from the small, easily accessible plants and avoid the taller ones. The leaflets may be bristly along the margins and the three nerves above and beneath, or completely unarmed, and variations between these extremes are also seen. Sometimes the leaflets are porrect and closely set, but leaflets that are spreading or even somewhat reflexed may also occur, the latter tending to be also completely unarmed, and so approaching very near *C. laxissimus*. As the plants get older, there is a tendency for the spadices to become longer but so far no spadix has been seen which is as long as that of *C. laxissimus*, or a spadix having long and diffuse branches and spikelets as in the latter.

In Kiah and Moysey 31,802 (from Trengganu) the leaflets are opposite, short, sometimes reflexed, but the spadix is very short, much shorter than the leaf. The petiole shows the signs of geniculation; probably this represents a leaf from an old stem. Other specimens from Trengganu collected by Hislop also have similar leaflets. Kiah and Moysey 31,802 as to the spadix and the fruits compare favourably with Burkill & Holttum 8,421 (Pahang), but here the leaflets are unarmed except on the margins of the upper portions of the leaflets, and in shape and arrangement are like those of the typical *C. perakensis*. Symington & Kiah 28,871 (Pahang) represents a shoot (from an aerial stem ?) of a plant bearing a short flowering spadix which is much smaller than the leaf (which in itself is very short); but the leaflets are distant and quite unarmed as in *C. laxissimus*, though the spadix is typical of *C. perakensis*. Ridley's specimen from Bukit Kutu (Selangor) and Ridley 12,116 (female from Selangor) show very short hooked claws in the axis of the spadices, though the first mentioned spadix is completely erect, while the latter may be bent or pendulous in the upper portion; there is no doubt that both these belong to *C. perakensis*. Perhaps because of these hooks on the axis of the spadix, and because of its pendulous nature, Beccari was inclined to regard the spadix in Ridley 12,116 as belonging to *C. Guruba*, a species which does not occur in Malaya. The type of *C. perakensis* (Scortechini 317[b] from Perak) has one spadix (out of the two) which bears claws on its axis (cf. Beccari t. 108).

In view of this variation *C. laxissimus* may prove to be an adult form of *C. perakensis* developed vigorously in suitable conditions on a mountain. Collectors have therefore to make a series of collections in the field to show the different gradations, especially

from the plants found in the primitive jungle on the mountains. *C. laxissimus* was wrongly placed by Beccari in his Group V.

In Wray & Robinson 5,327 (Pahang) the spadix is of *C. perakensis*, while the leaf is of *C. elegans*.

39 (a). Calamus perakensis Becc. var. **gracilis** Furtado **var. nov.**

C. perakensis var. *lanata* Ridl., Fl. Mal. Pen. V (1925) 59 quoad specimen Haniff & Nur 8,127 tantum.

A taxo typico haec varietas caudice graciliore, foliis minoribus, foliolis angustioribus differt.

Leaf about 25 cm. long, up to 5 mm. wide at the base, not geniculate, armed along the dorsum with a row of distant, up to 15 mm. long, patent spines, and along the margins at the base with closely set, porrect, up to 4 cm. long, spines, the latter becoming gradually patent, shorter and more distant in the distal parts of the petiole; rachis 40–50 cm. long with closely set, 10–15 mm. apart leaflets and with a row of very short, solitary spines in the dorsum. *Leaflets* 15–20 cm. long, 10 mm. or less wide, alternate or opposite, linear, gradually tapering to a bristly apex, setose along the margins and the 1–3 nerves above, and minutely setose on the 3 nerves beneath. *Spadix* erect, 35–40 cm. long, with 2–3 branches.

MALAYA: Pahang, Gunong Tahan in loco Wray's Camp dicto (Ridley 16,293 holotypus); Gunong Tahan, alt. 1,200–1,300 m. (Haniff & Nur 8,127).

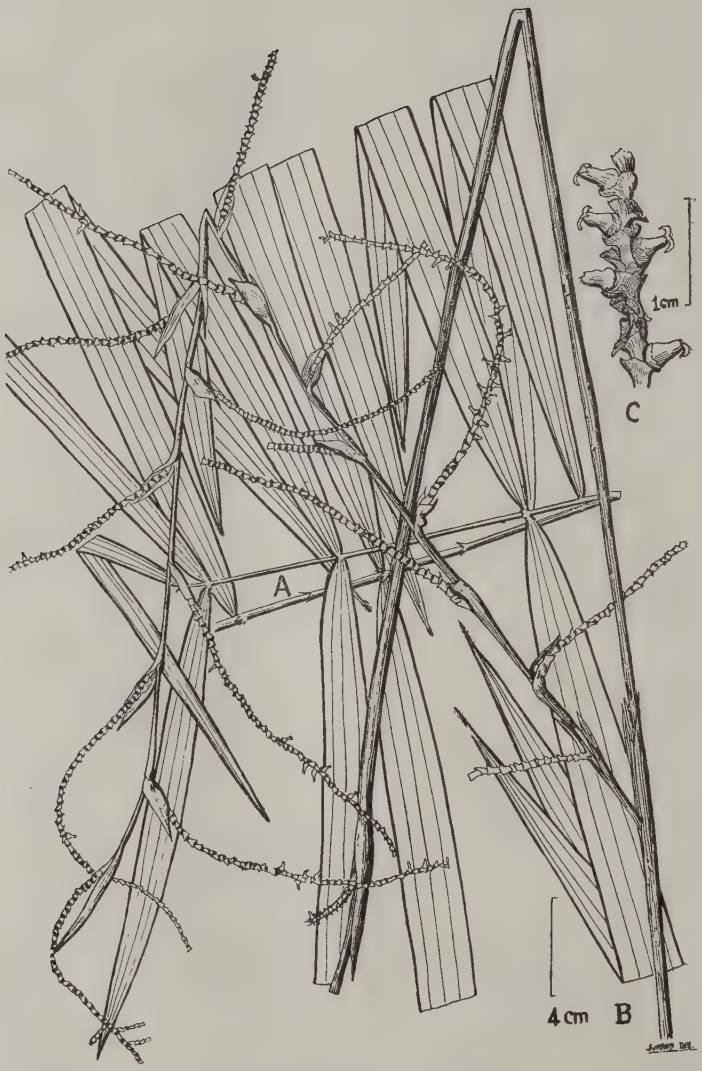
This variety has much smaller, closely set, narrower leaflets which are 13–15 cm. long, 10 mm. or less wide, and 12–15 mm. apart. Judging from the leaf-base, the stem appears to be very slender, and a field note states that it is 6–8 inches tall.

40. Calamus laxissimus Ridl., Mat. Fl. Malayan Pen. II (1907) 210; Becc. in Ann. Roy. Bot. Gard. Calc. XI Appendix (1913) 32 t. 17; Ridl., Fl. Malay Pen. V (1925) 63.—**t. 40.**

Stem apparently scandent, slender. *Leaf-sheaths* not seen, probably flagelliferous and gibbous. *Leaves* non-cirriferous, size not known; rachis armed with simple, or 3-digitate by confluence, claws. *Leaflets* in rather distant pairs, exactly opposite or sub-opposite, 5–9 cm. apart, ensiform, 1–3 costulate, largest about 35 cm. long, 25–28 mm. wide, unarmed. *Spadix* very long, 1·5–2 m. or more long; divided into 4–6 branches and armed with a few claws; female spikelets 5–15 cm. long, 3–4 cm. apart; borne on the long primary branches, each up to 40 cm. long, male branches often twice divided; the secondary spikelets very short with only 2–3 very closely packed flowers on each side. *Primary spathes* long, tubular, longitudinally slit towards the apex, where they end often in stiff divisions, each division being about 15 cm. long; secondary spathes obliquely truncate, ligulate and fimbriate at the apex. *Fruits* not known.

MALAYA: Pahang, Tahan River (Ridley in 1891, syntype).

I have seen the female syntype only. A part of the male syntype formed the basis of Beccari's description and plate 17 quoted above.



Tab. 40. *Calamus laxissimus (Ridley ♀, syntypus).*
A, Frondis pars. B, Spadicis pars. C, Spiculae pars ut spathellae, involucrophori, involucri, areolae, flores feminei appareant.

Beccari placed *C. laxissimus* in his Group V, when it obviously belongs to his Group VI. This species requires further investigation; for some forms of *C. perakensis* approach very near to this in regard to the leaflets and their armature. A tendency has been noticed in *C. perakensis* to climb and produce somewhat longer spadices. Will *C. perakensis*, when allowed to grow as a climber in a primitive jungle, transform itself into *C. laxissimus* ? So far no specimen of *C. perakensis* has been found to link this species with *C. laxissimus* which has very long spadices, and long branches or spikelets.

Both male and female syntypes were collected at the same time and in the same place, and it is possible that, though the spadices were collected from two different plants, the leaf specimens in both these collections were from the same plant. The collector, Ridley, distributed the two syntypes as if both were from the same plant.

VI Sectio COLEOSPATHUS Griff. **emend** Furtado
subsectio COLEOSPATHUS

Coleospathes (vel Coleospathae) Griff. in Calc. Journ. Nat. Hist. V (1845) 33 et 60, et Palms Brit. Ind. (1850) 8, 35, et in obs. pp. 43 et 71: pro parte; (Coleospathae) Drude in Engl. u. Prantl, Pflanzenf. II (1887) 52 partim; Baill., Mon. Palm. (1895) 60 pp.

Mischanthectae Ridl., Mat. Fl. Mal. II (1907) 189 et Fl. Mal. Pen. V (1925) 48 p.p.

Plantae scandentes vel acaulescentes, non-scandentibus exceptis flagelliferae. *Frondes* ecirriferae vel subcirriferae vel imparipinnatae (ex planta juvenili interdum longe cirriferae), in foliolis linearibus vel lanceolatis vel ellipticis divisae. *Spadices* frondibus longiores, flagelliformes. *Spathae* stricte tubulares. *Spiculae* sessiles. *Involucrophora* sessilia.

DISTRIBUTIO: India meridionalis (Malabaria), Ceylonia, et Indomalesia (i.e. India septentrionalis, Bengalia, Birmania, Indochina, Siamia, Insulae Anadamanicae, Java, Sumatra, Borneo, usque ad insulas Philippinas, Celebesicas et Mollucanas, et Novam Guineam).

LECTOTYPUS: *C. tenuis* Roxb.

Griffith did not adopt a uniform spelling for the epithets he employed to designate the Calamus sections, and sometimes used both singular and plural forms. Under *Coleospathus* Griffith included all the Calami which did not fall into his section *Platyspathus* and two other sections created to retain Daemonorops as a subgenus of Calamus. The subsequent authors who followed Griffith adopted the Latin feminine plural form of Griffith's sectional epithets, but did not change the sectional limits.

Beccari found the sections unworkable and divided the species into special Groups and separated Daemonorops as a valid genus. Ridley who agreed with Beccari in maintaining Daemonorops separate, ignored both Beccari's Groups and Griffith's sections, and divided Calamus into two new sections, *Mischanthectae* and *Phyllanthectae*, the former including the species of *Coleospathus* and *Platyspathus* in Griffithian sense.

As restricted here, *Coleospathus* includes only those species of Calamus which, while producing flagella on the leaf-sheaths of the climbing stems and closely sheathing primary spathes on the spadix, bear also sessile spikelets and involucrophores and no prominent cirrus at the end of the leaves, except in the leaves of the juvenile plants of some species. Usually the spadices are much longer than the leaves. The only species having premorse leaflets have been separated under the subsection *Caryotoideus*, and the sectional epithet having been repeated for the subsection including the lectotype of the Section. It seems possible to split this subsection further on the structure of the involucrophore and the involucre, and of the fruiting perianth; but this subdivision must be postponed until a study of a greater number of species, and with better specimens is possible. At present some species are known only from sterile material or male specimens, and in many others the fruit is not known.

Apparently *C. ornatus* is more allied to the section *Macropodus*, but it has been placed here because its involucrophores are not exsert, though the development of the involucre might mislead one to conclude that the involucrophores are pedicellate.

Key to the Species

(A) Leaves either short, ending in a long terminal flagellum, or long, divided into broad-elliptic, leaflets, or into leaflets which, if lanceolate-ensiform, are about 50 cm. or more long, and 5 cm. or more wide.

(B) Leaves flabellate with or without a few small leaflets towards the base. (Very slender palms, all drying black leaves 25–40 cm. long).

(a) Leaves with no separate leaflets below the flabellum, except in young stages (when present, basal leaflets not reflexed). Leaves distinctly petioled.

(b) Leaf-sheaths quite unarmed. Midrib of the flabellum armed below with hooked spines. (Leaves ± 40 cm. long).

C. flabellatus Becc.

(bb) Leaf-sheaths remotely armed. Midrib of the flabellum unarmed. (Leaves about 27 cm. long).

C. kemamanensis Furtado.

(aa) Leaves with 1–3 leaflets below the flabellum, sessile (± 30 cm. long); the two pairs of the basal leaflets reflexed, emplexicaul. (Midrib of the flabellum hooked below).

C. flabelloides Furtado.

(BB) Leaves subcirriferous or with apical leaflets free or shortly connate, not with a long flabellum.

(C) Leaves with the terminal pair shortly connate, and the second last pair very close to the terminal pair, the four terminal leaflets being the longest or as long as the mesial ones. (Stems slender with spreading or reflexed spines on the leaf-sheaths; leaflets about 15 cm. long or less, and up to 4 cm. wide, in one variety about 6 cm. wide. Fruit oblong, with explanate perianth; calyx as long as the corolla).

C. javensis Bl. varieties.

(c) Leaflets (excluding the terminal two pairs) 2–3 on each side, rarely 4; the lowest one pair of the leaflets obscurely reflexed, or not amplexicaul.

(d) Leaf-sheaths not striate, obscurely armed with a few, short, distant, recurved spines or almost unarmed (entirely unarmed and striate var. *laevis*).

var. **inermis** Ridl.

(dd) Leaf-sheaths conspicuously armed with small but stout, reflexed spines.

(f) All parts light coloured.

var. **tenuissimus** Becc.

(ff) All parts dry dark.

var. **purpurascens** Becc. (partly)

(cc) Leaflets generally more than 3 pairs below the two terminal pairs. The basal pair reflexed or amplexicaul (the two basal pairs usually approximate).

(i) Leaf-sheaths entirely unarmed and striate. (Leaflets rarely less than 3 pairs below the terminal two pairs).

var. **laevis** Furtado.

(ii) Leaf-sheaths armed.

(j) Leaflets below the two terminal pairs inequidistant or subequidistant, not in groups. (Leaflets 8 or more on each side of the rachis, rarely 7. Leaf-sheaths spines patent).

var. **polyphyllus** Becc.

(jj) Two pairs of leaflets below the two terminal pairs approximate or somewhat separate from the rest. (Leaflets 7 or less on each side of the rachis).

(k) Leaflets dull khaki-brown in colour with a polished surface. (Leaf-sheath spines usually spreading). Stems also of khaki colour.

var. **peninsularis** Becc.

(kk) Leaflets and stems dull, dark, not shining.

(l) Leaflets broad in the species the middle ones about 6 cm. broad. Leaf-sheaths with a few short, stout, recurved spines.

var. **purpurascens** Becc. (partly)

(ll) Leaflets very narrow, 2.5–4 cm. broad, leaf-sheaths armed with many unequal, patent, or slightly reflexed spines.

var. **pinangianus** Becc.

(CC) Leaves with 4 terminal leaflets not in a group.

(D) Spines on adult leaf-sheaths ascending, short with a swollen base. (Plants drying yellowish green).

(m) Adult leaves ecirriferous, with terminal leaflets connate at base. Leaflets broadly elliptic.

(n) Leaves sessile, about 30 cm. long, largest leaflet 12 cm. long, 3 cm. wide. Spadix nearly double the length of the leaves.

C. penicillatus Roxb.

(nn) Leaves petiolate, 80 cm. or more long (occasionally shorter?) Leaflets 20 cm. long, 7 cm. wide, or larger (rarely smaller). Spadix very long (in young plants the spines spreading or slightly reflexed).

C. insignis Griff.

(mm) Adult leaves shortly cirriferous or subcirriferous. Leaflets obovate-lanceolate, or elongate-lanceolate.

(o) Stem 10–12 mm. through. Leaves 40–50 cm. long, with 2–4 leaflets on each side. (Spadix slightly longer than the leaves). Leaflets 20–28 cm. long, 5–6.5 cm. wide. Fruit 10 mm. long.

C. spathulatus Becc.

(oo) Stem 20–22 mm. through. Leaves a metre long or more, with more than 4 leaflets on each side. Leaflets 28–40 cm. long, 6–8 cm. wide. Fruit 15 mm. long.

C. spathulatus var. **robustus** Becc.

(DD) Spines on adult leaf-sheaths, when present, spreading or reflexed, not swollen-based.

(p) Leaves with a pair of connate leaflets at the end. (Stem 10–20 mm. thick, fruit 10–12 mm. long).

(q) Leaf-sheaths without any wrinkles or markings, armed with scattered, 5–10 mm. long, narrow, spreading or slightly reflexed spines, Leaflets below

the terminal pair 1–3 on each side. Spadix filiform, fruiting perianth explanate. Fruit scales straw coloured with brown margins. Involucre included in the involucrophore. (Stem 10–15 mm. thick).

C. filipendulus Becc.

(qq) Leaf-sheaths marked with horizontal black lines, wrinkled in parts and armed with up to 15 mm. long, reflexed spines with bulbous base. Leaflets below the terminal pair 8–9 on each side. Spadix stout, perianth pedicelliform. Fruit scales uniform, shining coffee-coloured. Involucre slightly exsert. (Stem 2 cm. thick).

C. speciosissimus Furtado.

(pp) Leaves terminating with 2 free leaflets or with one leaflet, or are subcirriferous (young ones with a long cirrus). (Stem 3–4 cm. thick or more. Fruit 10–12 mm. long or much larger. Fruiting perianth pedicelliform. Involucre exsert).

(r) Leaves subcirriferous (young ones with a long cirrus). Leaf-sheaths thickly fugaciously furfuraceous, light yellow, thickly armed with broad, flat spines; fruit large 3–3.5 cm. long, 2 cm. or more broad, with black scales.

C. ornatus var. **horridus** Becc.

(rr) Leaves paripinnate or imparipinnate at the apex. Leaf-sheaths polished brown, sparingly armed with remote, narrow, elongate spines. Fruit 12–14 mm. long, with coffee-brown scales.

C. Scipionum Lour.

(AA) Leaves long, without a terminal flabellum; the leaflets long, narrow, the largest 4 cm. wide, but mostly narrower and 1–3 nerved.

(E) Leaflets fascicled.

(a) Leaflets in distant fascicles, approximate at the base, divergently spreading, about 30 cm. long. (Leaves 1 m. long or more).

(b) Leaflets few, 4 cm. broad, in very distant opposite fascicles of 2–3 leaflets each. Petiole 6–8 mm. broad, remotely armed with a few slender spines up to 2 cm. long. Sheathed stem about 1–5 cm. in diam., armed with weak, slender, up to 1 cm. spines.

C. Moorhousei Furtado.

(bb) Leaflets many, 2–2.8 cm. broad; 2–4 or more leaflets to a fascicle, occasionally with a solitary leaflet interposed; fascicles opposite or alternate. Petiole about 2 cm. broad, armed with stout, 2–4 cm. long spines. Sheathed stem 2–3 cm. in diam., armed with stout, broad-based, 1–3 cm. long spines.

C. viminalis var. **fasciculatus** subvar. **pinangianus** Becc.

(aa) Leaflets not divergent, nor approximate at the base, irregularly grouped in fascicles, about 15–17 cm. or 30–50 cm. long.

(c) Female and male flowers not congested in glomerules. Leaves 1 m. or more long, with a long petiole; leaflets 30–50 cm. long, 3 cm. or more broad.

C. concinnus Mart. (partly).

(cc) Female flowers two at each spathel; male flowers 2–5 at each spathel. Leaves ± 60 cm. long, petiole short (3–6 cm. long); leaflets (largest) 15–27 cm. long, 15–17 mm. broad.

C. siamensis var. **malajanus** Furtado.

(EE) Leaflets not fascicled.

(F) Leaves sessile or almost so.

(d) Very slender rotan, ± 8–10 mm. in diam. with leaf-sheaths almost unarmed or provided with short, usually blunt warts (undeveloped

spines). Leaves up to 40 cm. long. Flagella exactly opposite the petiole, only very slightly below the margin of the leaf-sheath's apex.

C. pandanosmus Furtado.

(dd) Rotan usually much stouter having leaf-sheaths armed with sharp spines. Leaves much larger. Flagella or spadices arise laterally at or below the petiole base, not exactly opposite to the base.

(c) Leaf-sheaths densely rugose and provided with 1–3 mm. long, spines. Sheathed stem 1–1.5 cm. in diam. (Leaf-sheath spines ascending).

C. Corneri Furtado.

(cc) Leaf-sheaths not rugose; provided with 4–6 mm. or longer spines. Sheathed stem 1.5–2 cm. or more in diam.

(f) Sheathed stem about 3 cm. in diam. Leaf-sheath spines ascending. Leaflets 2–2.5 cm. broad and nearly 39 cm. long. Leaves sessile.

C. radulosus Becc.

(ff) Sheathed stem 1.5–2 cm. in diam. Leaf-sheath spines apparently not ascending. Leaflets 15–20 cm. long and about 1.5 cm. broad. Leaves shortly petiolate (by suppression of the basal leaflets?).

C. belumutensis Furtado.

(FF) Leaves distinctly petiolate.

(G) Dried specimens brown or dark brown (not straw-coloured) in all parts. (Fruiting perianth pedicellate, with calyx as long as the corolla).

(g) Leaf-sheaths rugose and armed with ascending or spreading spines.

(h) Leaf-sheath about 2 cm. in diam., prominently rugose. Leaflets 20 cm. or more long, mostly 15 mm. or more broad, usually not setose in the lower surface.

(i) Leaflets 28–35 cm. long, 2–2.5 cm. broad, 6–9 cm. apart, unarmed on both surfaces.

C. Tanakadatei Furtado.

(ii) Leaflets 20–28 cm. long, 1.25–2 cm. broad, 2.5–4 cm. apart, usually setose in the subprimary nerves above, unarmed beneath.

C. Holttumii Furtado.

(hh) Leaf-sheaths 15 mm. or less in diam., minutely rugose. Leaflets 15–25 cm. long, 10–12 mm. broad, 2–3 cm. apart, setulose on both surfaces.

C. rugosus Becc.

(gg) Leaf-sheaths not rugose, armed with reflexed (not ascending) spines.

(j) Secondary spathes and spathels densely scabrid. Leaflets 40–50 cm. long, 2.5–3 cm. broad, 5–10 cm. apart.

C. scabridulus Becc.

(jj) Secondary spathes and spathels slightly or not scabrid.

(k) Secondary spathes and spathels scarcely scabrid; secondary spathes often aculeolate. Leaflets 5–7 cm. apart and 2.5–3 cm. broad.

C. luridus Becc.

(kk) Secondary spathes and spathels slightly scabrid. Leaflets 2–3.5 cm. apart, and 15–17 mm. broad.

C. laxiflorus Becc.

(GG) Dried specimens light or straw coloured in all parts.

(l) Plants almost stemless or semiscandent. Leaflets 3–3·5 cm. broad. (Petiole very long. Fruiting perianth explanate).

C. concinnus Mart. (partly).

(ll) Plants scandent. Leaflets less than 3 cm. broad. (Petiole short, about 20–25 cm. long).

(m) Leaf-sheath densely armed with large and small solitary, up to 4 cm. long spines, often longer at the mouth. Petiole bases densely armed with shorter spines. The lower primary spathes densely armed with short, up to 5 mm. long, often confluent spines. (Flowers unknown; juvenile leaves with fascicled leaflets).

C. balingensis Furtado.

(mm) Leaf-sheath, petiole-base, and lower-primary spathes armed with much smaller spines, often sparsely spinose.

(n) Female corolla twice as long as the calyx; fruiting perianth pedicelliform or almost so.

(o) Secondary spathes prickly, polished. Leaflets drying dirty green or khaki. Female involucre cup-shaped, with no conspicuously raised disc in the centre.

C. pulaiensis Becc.

(oo) Secondary spathes unarmed, striate, not polished. Leaflets green. Female involucre shallow with the central disc prominent.

(p) Leaflets setose on 3 nerves above, unarmed below the largest, 40–50 cm. long, 2–2.5 cm. broad. Leaf-sheaths rusty-furfuraceous.

C. chibehensis Furtado.

(pp) Leaflets setose on two lateral nerves above and on the

median nerve beneath, largest 25–35 cm. long, 15–18 mm. broad. Leaf-sheaths glabrous.

C. Burkilliánus Becc.

(nn) Female corolla as long as the calyx; fruiting perianth subpedicelliform (with involucre exsert).

(q) Spathels short, closely packed sub-bracteiform, without any long tubular part, the lower involucre reaching the rim of the upper spathel. (Fruit elongate; scales with dark brown margins, always? Leaves subcirriferous or paripinnate).

(r) Leaflets sparingly bristly on both sides. Secondary spathes unarmed or nearly so; spikelets exsert. Leaves subcirriferous when young, but later ending in two separate leaflets.

C. densiflorus Becc.

(rr) Leaflets smooth above, bristly beneath. Secondary spathes densely armed; spikelets arise a little below the mouth of the axillant spathe. Leaves generally subcirriferous.

C. Ridleyanus Becc.

(qq) Spathels long, tubular, with the axillary involucre and involucrophore remaining at the base of the higher spathel. (Secondary spathes unarmed. Fruit globose, with scales having no dark marginal line. Leaves paripinnate).

C. Diepenhorstii Miq. vars.

(s) Female spikelets spreading or reflexed.

(t) Leaflets setose on the median nerve above and on the two side nerves beneath.

var. **Diepenhorstii.**

(tt) Leaflets setose on the median nerve above only, or unarmed on both surfaces.

var. **singaporensis** (Becc) Becc.

(ss) Female spikelets arrect (in the same line as the axis of the partial inflorescence).

var. **kemamanensis** Furtado.

ENUMERATION OF THE SPECIES

41. Calamus flabellatus Becc. in Malesia II (1886) 62 and in Ann. Roy. Bot. Gard. Calc. XI (1908) 176 t. 37.—**t. 41.**

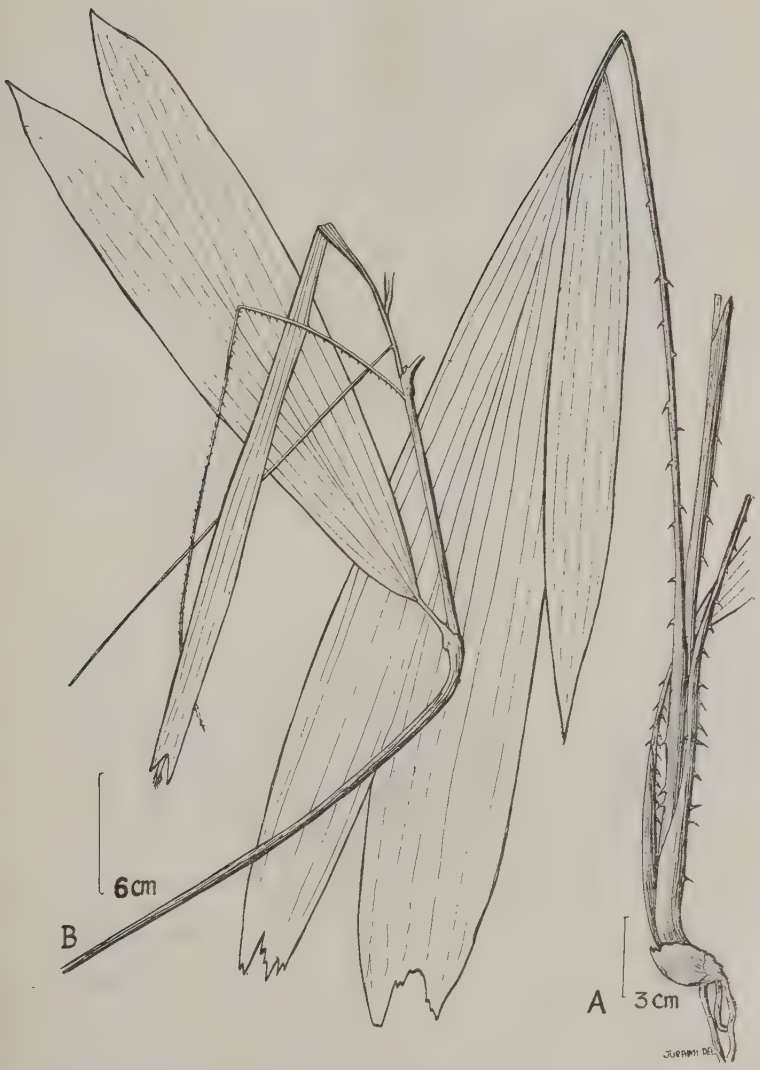
Stem solitary (?), scandent, very slender, about 2 m. or more long, 5–6 mm. in diam. *Leaf-sheaths* flagelliferous, gibbous above, distinctly striate, quite unarmed. *Leaves* simple, 38–45 cm. long, 7–10 cm. broad, elongate-flagelliform, gradually attenuate at base, bifid at apex, 6–8 costate on each side of the rachis, unarmed except for occasional small claws on the rachis beneath; petiole 2–4 cm. long, unarmed. *Spadix* and *fruit* unknown.

MALAYA: Johore, Sungai Kayu (Corner 32,768).

DISTRIBUTION: BORNEO (in Sarawak).

This species was described from an adult but sterile specimen collected by Beccari on Mount Matang in Sarawak. In the early stages of this rattan the leaf-sheaths are armed and not gibbous, and the leaves have an armed petiole about 15–25 cm. long, and a pinnule more often only on one side, but sometimes on both sides of the rachis. As the plants get older, the leaf-sheaths gradually become unarmed and gibbous, and the leaf-lamina, simple-flabellate, having a shorter petiole.

This is stated to be a good quality of rattan known in Sarawak where its type was collected by Beccari himself under the vernacular name of *Rotan Berman.* The further particulars about its growth habit are deduced from the specimens collected by Corner in Johore, which form the first record for the species in Malaya.



Tab. 41. *Calamus flabellatus (Corner 32,768).*

A, Caudex juvenilis erectus. B, Caudicis fragmentum sterilis scandentis cum foliis adultis et flagello.

42. Calamus kemamanensis Furtado **sp. nov.—t.t. 42 & 42a.**

A. C. flabellato, *cui affinissima ut videtur, haec species differt: caudicibus gracilioribus; frondibus minoribus angustioribusque, in pagina inferiore secus costas deciduo furfuraceis inermibusque, in pagina superiore secus costas setosis; ocreis longioribus.*

Caudex scandens vel subscandens, caespitosus ut videtur, gracillimus, 3–5 mm. in diam., circa 2 m. longus. *Vagina* frondis flagellifera, valde striata, aculeolis reflexis, solitariis, circa 1 mm. longis, remote armata, superne gibbosa, cum flagello filiformi ad latus gibbi producto. *Ocrea* 1–2 cm. longa, obscure striata, inermis, chartacea, mox marcescens. *Frondes* flabellatae; petiolus 4–5 cm. longus, deciduo fusco-tomentosus, dorso uniseriatim et remote aculeolatus vel inermis, in frondibus juvenilibus longior; flabellum 23–25 cm. longum, 7–8 cm. latum, apice ¼-bifidum, untrinsecus 5–6 costatum, basin versus arcuatim cuneatum, in pagina superiore secus costas marginesque apicem versus setosum, in pagina inferiore in costis deciduo tomentosum, et in rachide inerme. *Spadices* et alterae partes ignoti.

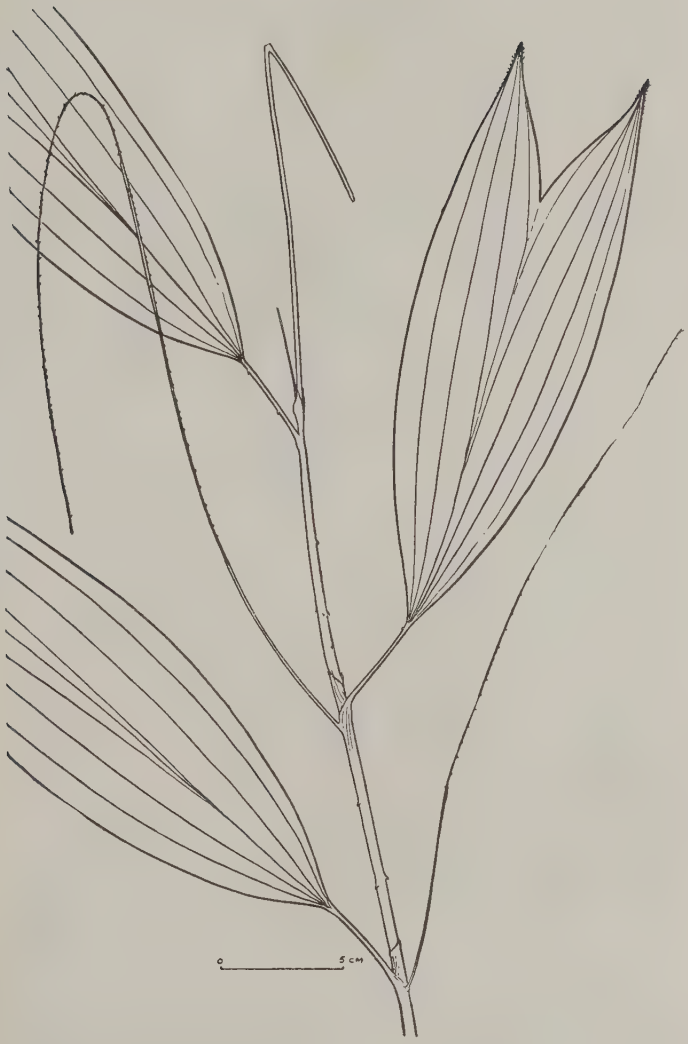
Stem climbing or subscandent, apparently tufted, very slender, about 2 m. long, 3–5 mm. in diam. *Leaf-sheaths* flagelliferous, strongly striate, gibbous above, armed with short, solitary, about 1 mm. long claws. *Leaves* flabelliform, about 27–30 cm. long, including the 4–5 cm. long petiole; the latter deciduously tomentose, armed with a few short, solitary claws arranged in a line on the dorsum; flabellum elongate, bifid at apex, curvedly cuneate towards the base, setose along the margins and on the main nerves above, unarmed and deciduously tomentose beneath. *Other parts* unknown.

MALAYA: Kemaman, prope flumen Malaice Sungai Nipa dictum (Corner 30,535).

This is the second Calamus species to have simple flabellate leaves, the other being *C. flabellatus*. It differs from the latter in its more slender stems, aculeolate leaf-sheaths, longer ocrea, and smaller leaves which are setose in the margins and in the main nerves above, and deciduously tomentose in the nerves beneath; the rachis is unarmed. The collector remarks that this is a "very slender rotan" with a "stem up to 7 ft. long, erect or more or less decumbent" and that its young leaves are purplish.

From the specimens available in the Singapore herbarium the following facts regarding its development have been deduced:

As the stem is flagelliferous and the petioles gibbose the species must be a climbing one at least in its later stages. However, when the stem finds no support to climb, it becomes decumbent, producing at its apex both roots and a rosette of "seedling" leaves. The latter are small, bifid flabellate, and bear short petioles having open sheaths. Very soon, however, the leaves become gradually longer, the petioles and sheaths being more armed than in the normal. At this stage the leaf will bear at the end of the petiole four leaflets, the two lateral ones being free and almost equal in size to the central two which, by their union, form the bifid flabellum. Later the lamina becomes normal (without the



Tab. 42. *Calamus kemamanensis (Corner 30,535—holotypus).*
Planta adulta sterilis.

Tab. 42a. *Calamus kemamanensis (Corner 30,535—holotypi pars juvenilis).*

Plantae insuffultus caudex nec geniculos nec flagella in frondium vaginis producit, sed saepe arcuatim procumbit; quum idem solum tetigisset, radices et folia juvenilia sicut istae in plantula ex semine creta gerit.

two lateral leaflets), but the petiole remains longer than in the normal leaves, and the leaf-sheaths, though tubular, are neither gibbose at the apex nor flagelliferous, showing thereby that the stem, in spite of its slenderness, remains erect for sometime during its early growth. It is only after this stage that plant becomes normal, producing flagella and gibbose petioles.

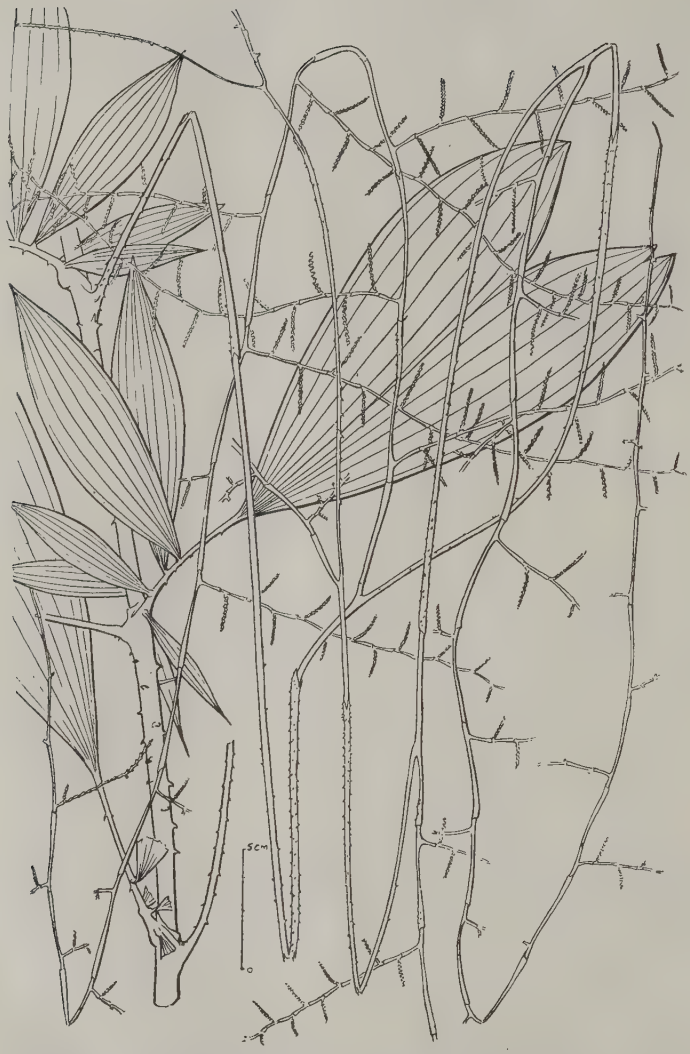
43. Calamus flabelloides Furtado **sp. nov.—t. 43.**

Inter species ad Sectionem Coleospathi typici pertinentes haec species facile distinguitur omnibus partibus in sicco nigrescentibus; vaginis frondium regulariter armatis, haud rugosis nec striatis; foliis minimis sessilibus apicem versus longae flabellatis, basin versus utrinsecus 3-foliolatis, duobus jugis foliolorum basalibus inter se valde approximatis, reflexis, amplexicaulis vel fere; spathis masculis tertiariis, spathelisque conspicue scabridis.

Caudix scandens, gracilis 8–12 mm. in diam. *Vagina* frondis flagellifera, aculeis 3–4 mm. longis, solitariis reflexis apice fuscis basi tumescentibus praedita, inter aculeos laevigata, in sicco nigrescens, infra petiolum geniculata. *Ocrea* oblique truncata, ad 5 mm. usque longa. *Frondes* 20–30 cm. longae, sessiles ecirriferae, infra in rachide aculeis reflexis haud digitatis praeditae. *Foliola* in sicco nigrescentia, secus margines costasque haud setosa, apice obscure setosa vel non; duo terminalia connata, flabellata, apice bifida, longissima, 20–22 cm. longa, 7–10 cm. lata, utrinque 7–9 costata; altera opposita vel fere, utrinsecus 3; duo infima elliptico-linearia, reflexa caulem amplectentia, circa 6 cm. longa, ad 1 cm. lata; duo subsequentia infimis valde approximata, reflexa, paulo latiora et longiora; duo mediana elliptica, circa 15 cm. longa, 2·5 cm. lata, patentia ab inferioribus 5–1·3 mm. et a flabello 3·5–4 cm. remota. *Spadix masculus* tantum visus, folio fere oppositus, basi valde tumescens, metralis vel longior, in inflorescentias partiales pendulas, ad 60 cm. longas supra orificium spathae orientes, duplo ramosas, divisus; ramis secundariis circa 20 cm. longis spiculas ad 3·5 cm. longas gerentibus. *Spathae* primariae et secundariae tubulosae, apice truncatae, paulo fissae, aculeolatae vel scabridae; tertiariae minute aculeolatae vel scabridae. *Spathellae* scabridae. *Flores* ignoti.

Stem climbing, slender, 3 m. or more long, 8–12 mm. in diam.; all parts dry dark coffee-brown. *Leaf-sheaths* flagelliferous, gibbous above, armed with distant, 3–4 mm. long, reflexed, black-pointed spines. *Leaves* 20–30 cm. long, sessile, non-cerriferous, armed on the dorsal side of the rachis with simple claws. *Leaflets* arranged in 4 pairs; the two terminal ones by far the largest, connate into an elongate flabellum, 20–22 cm. long, 7–10 cm. broad, 7–9 costate on each side of the rachis, bifid at the apex, gradually cuneate at the base; the other leaflets opposite or subopposite; the lowermost linear, amplexicaul, about 6 cm. long, 1 cm. broad; the others larger and much nearer the basal pair. *Male spadix* flagelliform, about a metre or more long, divided into 4 pendulous branches up to 6 cm. long; each subdivided into 7–20 cm. long secondary branches, each bearing 1·5–3·5 cm. long spikelets. *Spathes* primary and secondary tubular, truncate at the apex, aculeolate; tertiary densely scarbrid, as also the spathels. *Female spadix* not known.

MALAYA: Johore, in colle prope Sungai Kayu (Corner 29,284).



Tab. 43. *Calamus flabelloides (Corner 29,284—holotypus).*
Caudex pars ut folia, vaginae et spadix masculus appareant.

This species is readily distinguished by the scabridity of the tertiary spathes and the spathels and by the peculiar sessile leaves which have a reflexed pair of leaflets at the base and a very large, bifid flabellum at the apex.

The leaves of *C. impar*, which may be said to bear some resemblance to the leaves of this species, are petiolate and do not bear the two pairs of the basal leaflets. Further the armature or scabridity of the leaf-sheaths and spadix is totally different.

44. Calamus javensis Bl. var. **inermis** (Ridl.) Ridl., Fl. Malay Pen. V (1925) 51 pro parte.—**t. 44a.**

C. penicillatus var. *inermis* Ridl., Mat. Fl. Malayan Pen. II (1907) 192 pro parte (ex altera parte = *C. javensis* var. *laevis*).

Stem 5–7 mm. in diam. *Leaf-sheaths* gibbous, flagelliferous nonstriate, unarmed or armed with a few remote, short, reflexed spines. *Ocrea* hairy, fimbriately margined, deciduous. *Leaves* 30–35 cm. long, divided into 3–4 pairs of opposite or subopposite, inequidistant leaflets, excluding the terminal connate pair; the basal pair the smallest, hardly reflexed; the terminal 2 pairs the longest; the mesial leaflets 12–14 cm. long, about 2·25–2·50 cm. broad. *Spadix* as long as the leaves, or slightly longer, with one or two spiculiferous branches.

MALAYA: Negri Sembilan, Gunong Angsi (Ridley II–1908–Lectotype).

The two other syntypes of this variety have been excluded from here and cited under the var. *laevis*. Each leaf usually has three pairs of inequidistant leaflets, but sometimes the leaves have four pairs, that is, in addition to the terminal connate pair.

44. (a) Calamus javensis Bl. var. **tenuissimus** (Becc.) Becc. in Rec. Bot. Surv. Ind. II (1902) 201, and in Ann. Roy. Bot. Gard. Calc. XI (1908) 183 t. 39.

C. javensis var. *peninsularis* subvar. *tenuissimus* Becc. in Hook., f., Fl. Brit. Ind. VI (1892) 443.

C. penicillatus var. *purpurascens* Ridl., Mat. Fl. Malayan Pen. II (1907) 192 pro parte.

C. javensis var. *purpurascens* Ridl., Fl. Malay Pen. V (1926) 49 pro parte.

Stem tufted, 3–7 mm. thick. *Leaf-sheaths* armed with small scattered reflexed spines having a tendency to become claws. *Ocrea* 1–1·5 cm. long, fringed with long bristles, marcescent. *Leaves* 30–40 cm. long with 1·5–8 cm. long petiole, and leaflets usually 3, occasionally 4, on each side of the rachis (excluding the terminal connate pair), the lowermost spreading or somewhat reflexed.

MALAYA: Perak, Gunong Hijau alt. 1,400 m. (Burkill and Haniff 12,590); Kroh (Furtado 33,032). **Pahang,** loc. incert. (F.M.S. Forest Dept. No. 27,607).

Tab. 44a. *Calamus javensis var. inermis (Ridley s.n.—lectotypus).* Caudicis pars cum foliis, flagello et spadicibus.

This variety is easily recognised by the few leaflets to the leaves and by the spines of the leaf-sheaths having a tendency to change into reflexed claws.

The holotype of this variety (Scortechini 648[bis]), which was collected on Gunong Tambang Batak in Perak, has a long petiole. But since the spadix has only one small partial inflorescence at the end, it is obvious that the plant had just begun to flower and so the leaf had not acquired its normal adult stage. Scortechini 236[bis] also included in Beccari's plate, shows a petiole about 1·5 cm. long and it has a better developed spadix. All the specimens cited above are sterile, and they have been identified with this variety entirely on the spines of the leaf-sheath. Burkill and Haniff 12,590 have very long petioles (8–14 cm. long). Furtado 33,032 has leaflets which are displaced so as to be almost alternate; leaflets vary from 3–4 on each side (excluding the terminal connate pair) and the petiole varies also a great deal; in one specimen from the same plant the petiole is almost absent and the basal pair is somewhat reflexed.

44. (b) Calamus javensis Bl. var. **laevis** Furtado **var. nov.—t. 44b.**

C. javensis var. *inermis* Ridl., Fl. Malay Pen. V (1925) 51 pro parte.

C. penicillatus Roxb. (pencillatus) var. *inermis* Ridl., Mat. Fl. Malayan Pen. II (1907) 192 pro parte.

Differt a C. javensi *var.* inermi *Ridl., cui valde simillima, plantis robustioribus; vaginis frondium inermibus, striatis; frondibus majoribus; foliolis majoribus pluribusque, duobus basalibus valde reflexis; rachidibus frondium in plantis adultis robustisque valde armatis. A* C. javensi *var.* peninsulari, *cui affinissima differt vagina frondium inermi.*

Caudex cum vagina frondium inermi striata 6–12 mm. in diam. *Frondes* subsessiles circa 60 cm. longae, in stirpibus debilibus 30–50 cm. longae; foliola sine pari connato apicali utrinsecus 4–7, inaequidistantia, opposita vel subopposita, duo basalia caulem ampletentia, minima; rachis secus dorsum unguibus simplicibus vel digitatis validis armata. *Spadix* frondibus multo longior. *Fructus* oblongus, squamis per series 14–15 verticales dispositis.

MALAYA: Johore, Sedenak (Ridley 13,518–holotypus). **Malacca,** Bukit Besar in Ophir (Ridley 10,119–syntypus var. *inermis*); Gunong Ledang? (Ridley 3,475, vern. nom. *Rotan Tungal*). **Selangor,** Kuala Lumpur? (Collector Ridley in 1890).

This variety is easily distinguished by the complete absence of spines on the leaf-sheaths.

Tab. 44b. *Calamus javensis var. laevis (Ridley 13,518—holotypus).*
A, Caudicis pars cum folio. A_1 Spadix. B, Fructus.

In the shape and the size of the leaves and leaflets this variety might be easily mistaken for the var. *peninsularis*, but the leaf-sheaths in the latter are spiny. From the var. *inermis* sensu restricto, the var. *laevis* is easily distinguished by the larger dimensions of the leaves and by more numerous and larger leaflets. The var. *sublaevis* from Borneo has some resemblance to this variety, specially in the size and the shape of the leaflets and in the striate leaf-sheaths, but the petioles in var. *laevis* are almost absent whereas they are conspicuously long in the var. *sublaevis*. It is possible however that the latter is only a juvenile form as the long petioles suggest, and if so, it is necessary to study the adult form of the variety before the former can be adequately compared with the latter.

The Selangor specimen is not typical and is cited here with some doubt. Ridley 3,475 from Gunong Ledang in Malacca might belong here, though the specimen seems to have been taken from a weak plant or from a young clump; this has a much more slender stem, very narrow leaflets and undeveloped spines on the leaf-rachis. It was cited by Ridley as a syntype of his var. *inermis*.

44. (c) Calamus javensis Bl. var. **polyphyllus** (Becc.) Becc. in Rec. Bot. Surv. Ind. II (1903) 201, and in Ann. Roy. Bot. Gard. Calc. XI (1908) 184 t. 40.—**t. 44c.**

C. amplectens Becc. in Malesia II (1884) 78 and (1886) 278 t. 64 f. 4 **syn. nov.**

C. javensis Bl. *sensu* Ridl., Fl. Mal. Pen. V (1925) 49 pro parte.

C. javensis var. *peninsularis* subvar. *polyphyllus* Becc. in Hook., f., Fl. Brit. Ind. VI (1892) 443 (**basinym**).

C. javensis var. *tetrastichus* Bl. *sensu* Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 182 partly and t. 38 lower figure and Appendix (1913) 15.

C. javensis var. *intermedius* (Becc.) Becc. in Rec. Bot. Surv. Ind. II (1903) 201 and in Ann. cit. p. 185 t. 38 upper figure and Appendix (1913) 16. **syn. nov.**

C. javensis var. *peninsularis* subvar. *intermedius* Becc. in Hook., f., Fl. Brit. Ind. VI (1892) 443.

C. penicillatus Roxb. *sensu* Ridl., Mat. Fl. Mal. Pen. 11 (1907) 192 pro parte.

This variety generally bears 8 or more leaflets (occasionally less) on each side of the leaf-rachis. The leaflets below the terminal two pairs and above the basal two may be subsequidistant, alternate or subopposite, sometimes irregularly grouped in two on each side. Leaf-sheaths are usually densely armed with horizontal or slightly ascendent

Tab. 44c. *Calamus javensis var. polyphyllus (Furtado 33,068).*
A, Caudicis pars cum folio et spadice. B, Fructus. C, Semen. D, Idem verticaliter discissum.

or sometimes deflexed spines about 5–6 cm. long. The basal pair of leaflets is the smallest and is usually reflexed; the pair above the basal one has somewhat larger leaflets, but are much smaller than the other.

MALAYA: Kedah, Baling, 5½ mile Kroh Road (Furtado 33,053); Bukit Seblak in Weng (Furtado 33,068); **Perak,** Kroh (Furtado 33,031); Bukit Chong in Kroh (Furtado 33,023); Taiping Hill, alt. 800 m. Burkill and Haniff 13,219, vern. nom. *Rotan Seni* or *Rotan Sindek*); Mengkaran River (Anderson 168); Cottage Hill, 1,600 m. (Curtis, IX–1889); Upper Perak (Wray 3,460 vern. nom. *Rotan Snie*); Larut Hills (Anderson 168); Ulu Temango (Ridley 14,706). **Kelantan** Kuala Lebir (Gimlette, cult. in Botanic Gardens, Singapore, V–1906). **Pahang,** Fraser Hill, alt. 1,400 m. (Burkill & Holttum 7,814). **Malacca,** Bukit Sedenan (Derry's collector, 80, vern. nom. *Rotan Lelin*); Chabau (Alvins 2,303, vern. nom. *Rotan Lilin*). **Selangor,** Klang Gates (Hume 7,302); Pahang Track (Machado in V–1903). **Johore,** Gunong Panti (Ridley, 12–XII–1892, vern. nom. *Rotan Lilin*).

BORNEO: Kuching in Sarawak (Hewitt, vern. nom. *Rotan Anak*).

SUMATRA: Enggano in Palembang (Lutjerharms 4,253 vern. nom. *Rotan puledas ekehi*); Palembang cult. in Botanic Gardens, Buitenzorg, sub. no. XII. D. 6ª (Furtado 30,829) et sub. no. XII. C. 94 (Furtado 30,842).

This variety differs from the others of this species in having many, more or less equidistant leaflets, the middle two pairs of leaflets are never grouped as in the type form. Beccari's plate 38 (lower figure) depicts fully developed leaflets, but in the plate 38 (upper figure) and in plate 40 somewhat younger leaves are shown. After seeing many other variations exhibited by younger growths, I find that the variety *intermedius* cannot be neatly separated from var. *polyphyllus*. In young plants the leaves often have long petioles so that the petiole length is often a dangerous criterion to distinguish between the varieties of this species.

C. javensis var. *tetrastichus* from Borneo as described by Blume is a variety having fewer leaflets.

This variety is easily separated from the var. *peninsularis* by the mesial pairs of leaflets which are partly or not at all neatly opposite and by the two pairs immediately below the terminal two not being approximate.

44. (d) Calamus javensis Bl. var. **peninsularis** Becc. in Hook., f., Brit. Ind. VI (1892) 442 and in Ann. Bot. Gard. Calc. XI (1908) 178 and Appendix (1913) 15.—**t. 44d.**

C. javensis Bl. *sensu* Ridl., Fl. Malay Pen. V (1925) 49 t. 213.

C. javensis var. *purpurascens* Ridl., op. cit. p. 49 pro parte.

C. penicillatus Roxb. (*pencillatus*) *sensu* Ridl., Mat. Fl. Malayan Pen. II (1907) 191 pro parte.

C. penicillatus var. *purpurascens* Ridl., Mat. cit. (1907) 192 pro parte.

Tab. 44d. *Calamus javensis var. peninsularis (Furtado 33,102).*
A.Caudicis cum folio. B, Pars spadicis fructiferentis. C, Fructus. D, Semen. E, Idem verticaliter discissum.

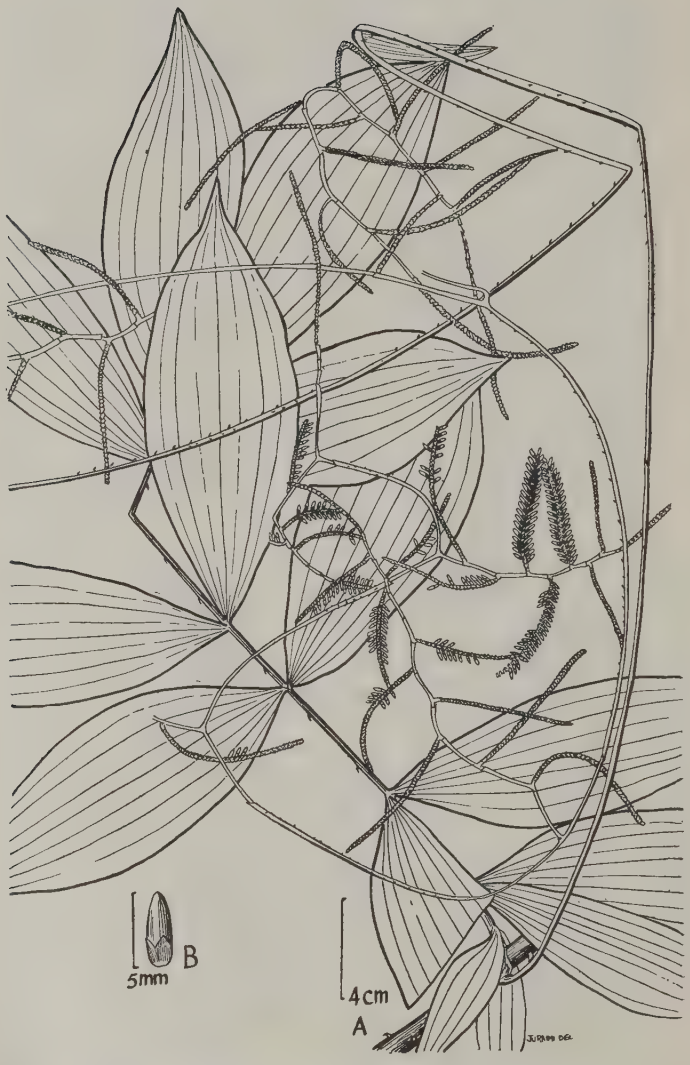
Stem tufted, scandent, about 10 m. long, 7–10 mm. in diam. *Leaf-sheaths* flagelliferous, slightly gibbous above, armed with solitary, scattered, short or long, 1–3 mm. or 6–8 mm. long, horizontal or very slightly reflexed, often scurfy-margined spines. *Leaves* subsessile or with a 1–2 cm. long petiole, non-cirriferous, 40–50 cm. long; rachis deciduously scurfy, densely armed beneath along the middle and the margins with simple or 2–3 digitate black tipped claws. *Leaflets* distinctly 3-nerved, elliptic, unarmed except in the margins, 7 pairs of opposite leaflets including the terminal connate pair; the second last pair very close to the terminal one and slightly longer than it; the next two pairs somewhat approximate, and separated by longer distance from the ones below or above them on the rachis; the basal pair smallest, reflexed, amplexicaul; the next pair slightly larger and often reflexed; the other pairs subequal; the mesial the largest, 15–25 cm. long, 4–5 cm. broad. *Spadix* male very like the female, flagelliform, much longer than the leaves, divided into 2–4 branches, 10–20 cm. long, each bearing 6–8 cm. long, divaricate, alternate spikelets. *Primary spathes* long, tubular, aculeate, secondary spathes remotely aculeolate, tubular, ligulate, 1·5–2 cm. long. *Fruiting perianth* explanate. *Fruit* oblong, rarely globose, mucronate, 9–11 mm. long, 6–8 mm. in diam; scales arranged in 15–18 (rarely in 18–21) vertical series, channelled in the middle, light brown, paler on the margins, with dark brown tips or intramarginal lines; seed with homogeneous albumen.

MALAYA: Pahang, Kuala Tembeling (Ridley in 1891); Bentong on Raub Boundary (Furtado 33,102). **Johore,** Sungai Kayu (Kiah, 17–III–1937); Kuala Sembrong (Lake and Kelsall, 21–X–1892, vern. nom. *Rotan Lilin*); Tempayang River (Ridley 13,295). **Singapore,** Kranji (Mat, IV–1895); Bukit Timah (Ridley, in 1896); Botanic Gardens, cultivated (Ridley in 1894 and 30–XII–1895).

As Beccari has not published any drawing of this and as I was not able to see any specimen named by him, I do not feel fully confident that I have interpreted Beccari's variety correctly. Beccari described it as having 3–6 leaflets on each side of the rachis, "but never grouped on one side" of it, and globose fruits. In the variety described above the leaflets are ordinarily in 7 pairs, the second last pair (i.e. the sixth pair from the base) is very close to the terminal connate pair, the 4th and the 5th pairs are somewhat approximate, and the fruits are generally oblong, rarely globose. Ridley 13,295 (Johore) have nearly globose fruits with the scales arranged in 18–21 series (instead of 16–18). There appears to be some confusion in Beccari's own interpretation of the variety. Thus Beccari (1908) has cited King's Collector's No. 7932 in Herb. Calcutta both under the var. *peninsularis* and the var. *peninsularis* subvar. *purpurascens*, and Scortechini 236 in Herb. Beccari both under var. *peninsularis* and var. *intermedius*.

44. (e) Calamus javensis Bl. var. **purpurascens** [Becc.] Ridl., Mat. Fl. Mal. Pen. II (1907) 192 et Fl. Malay Pen. V (1925) 49 pro parte.—**t.t. 44e & 44f.**

C. javensis var. *peninsularis* subvar. *purpurascens* Becc. in Hook., f., Fl. Brit. Ind. VI (1892) 443, and Ann. Roy. Bot. Gard. Calc. XI (1908) 181.



Tab. 44e. *Calamus javensis var. purpurascens (Wray 2,606).*
A, Caudicis cum folio et spadice masculo. B, Flos masculus.

The leaflets in this variety are arranged in the same way as those in the var. *peninsularis* and are also 7 on each side. The two pairs of leaflets immediately below the two terminal pairs are separated by a longer distance from those above or below them, and the basal pair is the smallest, reflexed, and amplexicaul. However, it differs from the var. *peninsularis* in its broader leaflets (5–6 cm. broad), in the fewer and broader but distinctly reflexed spines, and in the darker colour in all the parts of the dry specimens. Wray 981 (female) from Gunong Batu Puteh in Perak appears to belong here but the leaflets in the female leaves are fewer with no reflexed leaflets at the base.

Of all the Malayan varieties of *C. javensis*, the var. *purpurascens* has the broadest leaflets.

MALAYA: Perak, Relau Tujor (Wray 2,606); Batu Kurau (Haniff 13,257).

The syntypes of this species were from Penang and Perak. I have seen neither of these, but my interpretation of this variety is entirely from the description given by Beccari. Ridley who interpreted this variety on the presence of the purple colour of the leaves and spadix axis, cited under this variety a number of specimens belonging to other varieties which also have purple leaves. This purple colour seems to be a passing phenomenon brought about by certain conditions of age and surroundings.

44. (f) Calamus javensis Bl. var. **pinangianus** (Becc). Ridl. (*penangianus*), Fl. Malay Pen. V (1925) 51.

C. javensis var. *peninsularis* subvar. *pinangianus* Becc. (*penangiana*) in Hook., F., Fl., Brit. Ind. VI (1892) 443, and Ann. Roy. Bot. Gard. Calc. XI (1908) 182.

C. penicillatus var. *pinangianus* (Becc.) Ridl. (*penangianus*), Mat. Fl. Malayan Pen. II (1907) 192.

This variety has its leaflets arranged as in the var. *peninsularis* and the var. *purpurascens*, but they are very much narrower (15–18 cm. long, 2·5–4 cm. broad). The spines on the leaf-sheaths are numerous (much more numerous than in both the above-mentioned varieties and longer than those of the var. *purpurascens*) and somewhat reflexed. The specimens usually dry blackish.

MALAYA: Penang, Waterfall Valley (Curtis, X–1898); Mount Elvira, alt. 650 m. (Curtis, IX–1894 vern. nom. *Rotan Sini*). **Perak,** Gunong Hijau, alt. 1,200 m. (Holttum: A).

The basal leaflets are described by Beccari (1908) as not being deflexed, but in both Penang specimens cited above the basal leaflets are strongly deflexed. Perhaps the type was from young growth which is also suggested by the mottles on the sheaths (described by Beccari).

Beccari (1908 and also in Rec. Bot. Surv. Ind. II, 1902 p. 201) spelt the subvarietal epithet as *pinangianus* despite the facts that he always spelt the anglicised name of the island as "Penang"; and that the epithet was originally spelt as *penangiana*, perhaps by Hooker fil. who had edited Beccari's notes.

Tab. 44f. *Calamus javensis var. purpurascens ? (Wray 981).*
A, Caudicis fragmentum feminei cum folio et spadice. B, Fructus juvenilis.

Kiah & Moysey 33,630 matches well with the Penang specimens, but has not become dark on drying, and so may yet form another variety. Haniff collected a specimen in Langkawi which is midway between this and var. *polyphyllus*, but better leaves are needed for its correct identification.

45. Calamus penicillatus Roxb. (pencillatus) Fl. Ind. III (1832) 781; Mart., Hist. Nat. Palm. III ed. 1[a] (1838) 210; Griff. in Calc. Journ. Nat. Hist. V (1844) 56 and Palms Brit. Ind. (1850) 66; Mart., op. cit. III (1850) 334; Becc. et Hook. f., Fl. Brit. Ind. VI (1893) 462; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 500, in observ. sub. *C. javensis* p. 181, et in Appendix (1913) 15 and 73; Ridl., Fl. Mat. Pen. II (1907) 191 pro parte typica.—**t. 45.**

C. Martianus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 459 et in Ann. Roy. Bot. Gard. Calc. XI (1908) 353 t. 151.

C. penangensis Ridl., Mat. Fl. Malayan Pen. II (1907) 192, et Fl. Malay Pen. V (1925) 51.

Stem scandent, 3–4 m. long, 6 mm. in diam. *Leaf-sheaths* light-yellowish when dry, gibbous above, striate, sprinkled with small rusty scales, armed with small 1–2 mm. long, black-tipped, tumescent-based, ascendent spines, which are solitary or confluent at the base. *Leaves* non-cirriferous, usually paripinnate (but occasionally impari-pinnate, or subcirriferous ?) 30–40 cm. long, sessile or subsessile; rachis armed densely and irregularly on the dorsal side with black-tipped, solitary or 2–3 digitate claws. *Leaflets* few, 7–8 in all, remote, inequidistant, elliptic-lanceolate or oblanceolate, abruptly narrowed to a subulate, penicillate tip, opaque and yellowish-green on both surfaces, 5–8 costulate, unarmed on both surfaces and on the margins, transverse nervules very conspicuous; the terminal two leaflets slightly connate at the base; the basal two smallest, opposite or not; others alternate or irregularly disposed, the largest 13–15 cm. long, 2–3 cm. broad. *Female spadix* very slender, flagelliform, longer than the leaves, about 50–65 cm. long, including the filiform appendix, divided into 4–5 spiculiferous, 13–15 cm. long branches. *Primary spathes* tubular, aculeate or clawed, the longest about 6–8 cm. long; secondary spathes tubular, striate, unarmed, 1·25–2 cm. long. *Spikelets* slightly porrect or almost horizontal, 8–10 on each branch, 2·5–4 cm. long, alternate, bearing 8–12 female flowers; spathels infundibuliform, striate, unarmed, about 2 mm. long, apiculate. *Involucrophore* cupuliform, inserted at the mouth of the spathel; involucre cupuliform; areola semilunar, depressed. *Female flowers* in unopened buds enclosed in a strongly striate calyx. *Male spadix* similar to the female but the spikelets are slightly shorter and horizontal; spathels almost cylindrical, less ligulate; and the involucre seated entirely outside its own spathel.

MALAYA: Penang, Government Hill, alt. 600 m. (Burkill 750); West Hill (Curtis 2,268, holotype of *C. penangensis*). Endemic.

Curtis 2,268, which is represented by a female plant with several leaves and spadices, has formed the basis of the description of the female spadix and flowers not described before. The fruit is yet unknown, but species appear to be closely allied to *C. insignis*.

Tab. 45. *Calamus penicillatus (A–B: Burkill 750; C–D: Curtis 2,268).*
A, Caudicis cum foliis et spadice masculo. B, Spicula mascula. C, Ramus spadicis feminei. D, Spicula feminea.

The several leaves in the collections cited above have a terminal pair of leaflets which are connate at base, showing no trace of an abortive cirrus or a diminutive leaflet at the apex. Roxburgh described his species as having also a connate terminal pair. Hence the odd leaflet at the end of the specimen depicted and described by Beccari (1908) appears to be an unusual occurrence.

After studying the types and the descriptions of *C. penicillatus* Roxb., *C. Martianus* Becc. (= *C. penicillatus* Roxb. *sensu* Mart. 1950) and *C. penangensis* Ridl., Beccari (1913) concluded that these three names were synonymous, their types being specifically identical. No doubt Beccari (1913) supposed that the types of the first two were from the same gathering, but this could not have been; for Gaudichaud 37, the type of *C. Martianus*, was collected by Gaudichaud himself during his second voyage round the world, which was long after Roxburgh had drawn his description of *C. penicillatus*, or even long after Roxburgh's death. There was also some difficulty in identifying correctly Roxburgh's species, owing to the words "leaflets 3–4 pairs" in the manuscript being misprinted as "leaflets thirty-four pairs" (cf. Beccari, 1913 p. 15). But fortunately a reference to the original manuscript has shown the error. In view of this correction and also in view of the identification of the types, there is no reason to follow Ridley (1925) who has rejected both *C. penicillatus* and *C. Martianus*, and adopted *C. penangensis* as the correct name for the species. I have therefore followed Beccari and adopted *C. penicillatus*, as the correct name for this species.

46. Calamus insignis Griff. in Calc. Journ. Nat. Hist. V (1844) 59 and Palm Brit. Ind. (1850) 69; Becc. et Hook f., Fl. Brit. Ind. VI (1893) 459; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 364 t. 152; Ridl., Mat. Fl. Malayan Pen. II (1907) 193 partim; Becc. *op. cit.* Appendix (1913) 73; Ridl., Fl. Malay Pen. V (1925) 51 pro parte.—**t. 46.**

C. javensis sensu Ridl., Fl. *cit.* V (1925) 49 partim.

C. penicillatus sensu Ridl., Mat. *cit.* II (1907) 191 partim.

C. subspathulatus Ridl., Mat. *cit.* p. 194 partim et Fl. *cit.* p. 52 partim.

Stem scandent, 15–20 m. long, with sheaths 8–15 mm. in diam. *Leaf-sheaths* flagelliferous, straw-coloured, gibbous above, obliquely truncate at mouth, armed with 1–8 mm. long, black-tipped, ascendent or spreading spines (reflexed or horizontal in juvenile specimens). *Leaves* non-cirriferous; adult 40–85 cm. long with a petiole 12–18 cm. long, or almost sessile; juvenile leaf about 1 m. long, including 10–25 cm. long petiole; rachis with solitary or confluent claws arranged more or less in three series. *Leaflets* inequidistant, irregularly disposed,

Tab. 46. *Calamus insignis (Kiah 35,996).*
A, Caudicis fragmentum. B, Folium sine parte basali. C, Spadicis pars.

mostly alternate, subequal, 3–6 on each side including the terminal connate pair, broadly elliptic, or slightly broader in the upper half than in the lower, 6–9 costate, drying greenish on both surfaces, with paler colour on margins and nerves, chartaceous, unarmed except along the apical margins (transverse nerves very conspicuous), gradually or suddenly contracted at apex; the largest mesial, about 15–27 cm. long, 6–10 cm. broad. *Spadix* flagelliform, very long, with branches about 20–30 cm. long, each bearing about 15–20 alternate, 5–7 cm. long spikelets. *Primary spathes* tubular, clawed; secondary spathes about 1·5 cm. long, tubular, remotely aculeolate. *Involucrophore* and involucre cupuliform.

MALAYA: Kedah, Jeriang (Kiah 35,996). **Perak,** Bujong Malacca, alt. 500 m. (Curtis 3·161 syntype of *C. subspathulatus*); Lumut in Dindings (Ridley 9,472[I]). **Negri Sembilan,** Bukit Sutu in Sungai Ujong (Alvins 1,971, vern. nom. *Rotan Lilin*), loc. incért. in Sungai Ujong (Alvins s.n.); Bukit Senaling near Kuala Pilah (Moorhouse vern. nom. *Rotan Kechil, Rotan Snui* or *Rotan Sni*).

This species was based on the juvenile stem with leaves, and hitherto no flowering or fruiting material of it was known. The description given by Ridley (1907 & 1925) as of a fruiting spadix of this species, was based entirely on Ridley, 9,472[II], which is *C. Diepenhorstii* and which had become mixed with a collection of *C. insignis* (Ridley 9,472[I]).

My description of the adult leaves and female spadix is drawn from Kiah 35,996, which may be considered as the apotype of the species. The fact that the leaves appear to be irregular at apex in the young stages only suggests that the species should be placed in Group VI of Beccari, but the leaves and the armature on the leaf-sheaths show obvious similarities to *C. spathulatus* which belongs to Group XIII of Beccari.

Both Alvin's collections quoted here were cited by Ridley first (1907) under *C. penicillatus* and later (1925) under *C. javensis*. Ridley also regarded *C. spathulatus* Becc. as typical *C. insignis*. This last is distinguished from *C. spathulatus* in having more elliptic and chartaceous leaflets, in the divergence of the leaflets from the rachis at a greater angle (± 45°) (with cross nerves more noticeable), all the subprimary nerves being much thinner than the median costa.

The leaf with its petiole and leaflets vary in size, and from the meagreness of the specimens available it is difficult to form a definite opinion as to cause of this variation. Alvins 1,971 has a leaf which is 40 cm. long and almost sessile, and bears much narrower, smaller, elliptic leaflets; perhaps this leaf is from a terminal portion of a plant in its old age. This Alvin's specimen contains also a portion of a larger leaf having larger leaflets. In Alvins s.n., the leaf is represented by a terminal pair of connate leaflets which are also larger than in Alvins 1,971.

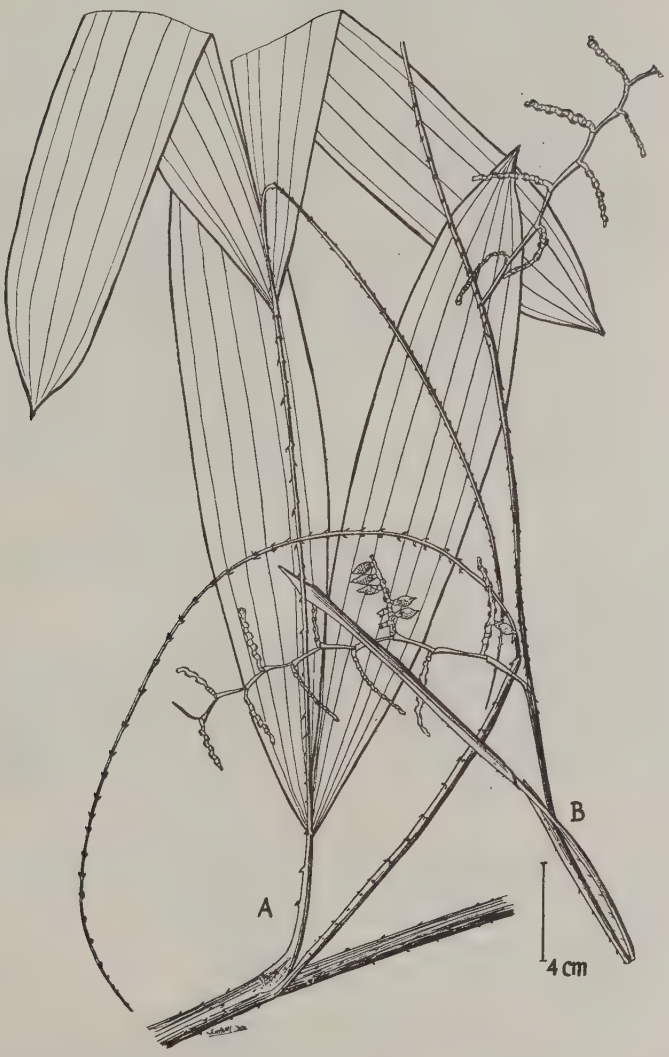
Curtis 3,161, in the Singapore herbarium is represented by two specimens (syntypes of *C. subspathulatus* Ridl.), both of which consist of bits of a leaf from a juvenile plant and bear no prickles on the leaf rachis; but in shape, size and texture the leaflets compare well with Scortechini's specimen from Perak, depicted by Beccari l. c. in t. 152 and examined by me in Florence which, however, bears prickles on the leaf-rachis. These prickles and the fact that it bears also a flagellum (the base of which is shown in the specimen) show that the plant was already in the climbing stage, and so compare well with the holotype collected in Malacca. Kiah 35,996, is obviously the same species and in regard to the characters and disposition of the leaflets compares well with all the specimens discussed above; its spadix is also of the type represented by the fragments in Alvin's collections. However its leaf-sheaths bear ascendent spines as in *C. spathulatus* and *C. penicillatus*; but in the juvenile stages the leaf-sheath spines appear to be horizontal or reflexed as described by Beccari (1908) t. 152. Moorhouse's collection represents a juvenile plant, having a leaf 70 cm. long including a 10 cm. long petiole, with its rachis armed beneath, but its leaflets are narrow as in Alvins 1,971, and similar to other specimens. Ridley 9,472[1] contains portions of a leaf having spines on the rachis, and the end tending to be imparipinnate, with the base of the end leaflet yet attached on one side to the lower leaflet; otherwise the topmost pair is free suggesting that this imparipinnate state is not normal. A tendency for adult leaves to be subcirrous or imparipinnate has not been noticed.

Both Alvin's collections bear spikelets having fruits which belong to *C. javensis*. The vernacular name given by Alvins may also be of *C. javensis* var.

47. Calamus spathulatus Becc. in Hook. fl., Fl. Brit. Ind. VI (1893) 459 et Ann. Roy. Bot. Gard. Calc. XI (1908) 360 t. 149, et Suppl. (1913) 73 sub *C. insignis*.—**t. 47.**

C. insignis Griff. *sensu* Ridl., in Journ. Roy. Asiat. Soc. Straits Br. 33 (1900) 175, Mat. Fl. Malayan Pen. II (1907) 193 et Fl. Malay Pen. V (1925) 51 partly.

Stem slender, scandent, about 10 mm. through. *Leaf-sheaths* flagelliferous, yellowish, gibbous above, armed with fine, short black-tipped, ascendent spines with a large bulbous or swollen base; flagellum as long as the leaves or longer. *Ocrea* up to 10 mm. long, smooth. *Leaves* 50–75 cm. long including the petiole, ending in a short clawed cirrus, or the latter decurrent in one of the terminal leaflets; petiole 3–18 cm. long, sparsely armed with short bulbous, reflexed spines along the dorsum, and sometimes also along the margins of the upper half, spines being at times altogether towards the base; rachis armed along the dorsum and often along the margins with similar but slightly longer claws, the last simple, approximate. *Leaflets* 2–4 pairs, distant,



Tab. 47. *Calamus spathulatus (Nur 11,560).*
A, Caudicis pars cum folio et flagello. B, Spadix fructiferens.

never in fascicles, usually opposite, rarely alternate, oblong-obovate or spathulate, smooth on both surfaces, abruptly narrowered into a short, obtuse bristly apex, the size depending upon the age of the plant; the largest 25–28 cm. long, 5·5–6·5 cm. wide; the smallest 10–15 cm. long, 3·5–4 cm. wide; in each leaf subequal, excepting the terminal ones, 3–7 costate; costae unequal; transverse veins numerous, conspicuous on both surfaces, continuous across the blade. *Female spadix* flagelliform, strongly clawed, about 1 m. long, ending with a strongly clawed appendix. *Primary spathes* closely sheathing, obliquely truncate, coriaceous, armed with reflexed spines, the basal spathes bifacial, others cylindical. *Practical inflorescences* few, distant, 10–30 cm., long divided into 5–13 spikelets; secondary spathes tubular, funnel-shaped, ligulate on one side, smooth, striate, or occasionally armed in the lower branches, 1·5–2 cm. long. *Spikelets* 2·5–7 cm. long, with 8–15 flowers on each side; spathels short funnel-shaped, truncate, slightly apiculate, smooth, striate. *Involucrophore* inserted, almost outside the mouth of the spathel, cupuliform. *Fruiting perianth* shortly but conspicuously pedicelliform; calyx nearly half the size of the corolla. *Fruit* oblong-elliptic, narrowed abruptly at both ends, 12 mm. long (with beak and perianth), 7 mm. broad; scales in 18–21 series, shining yellow, concolorous, or with reddish-brown tip; albumen equable, embryo basal. *Male spadix* not known.

MALAYA: Malacca, loc. incert. (Lobb; Hervey). **Selangor** (Alvins 253, as *Rotan Batu*, 70–80 ft. long). **Negri Sembilan,** Gunong Angsi, alt. 80 m. (Nur 11,560). **Johore,** Batu Pahat (Ridley in Nov. 1900, as *Rotan Batu*); Mount Austin (Ridley in 1904). **Singapore,** Bukit Timah Ridley, in 1892, as *Rotan Batu*); Garden Jungle (Ridley in Feb. 1903).

The type is Lobb's which I have not seen. I have followed Beccari's description and the plate of Hervey's specimen. All other collections cited here are sterile except Nur 11,560, which has very small fruits.

Ridley's collection from Mount Austin, Johore, which is a juvenile plant, has reflexed spines on the lowest internode, and ascendent ones on the two higher internodes. It appears therefore the spines become ascendent only as the plant grows older.

Alvins noted that this grows 70–80 feet long. Griffith's collector, E. Fernandez, recorded the Malayan name *Rotan Batu* for *C. insignis*.

47. (a) Calamus spathulatus Becc. var. **robustus** Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 459 et in Ann. Roy. Bot. Gard. XI (1908) 362 t. 150 et Appendix (1913) 73.—**t. 47a.**

C. subspathulatus Ridl., Mat. Fl. Malay. Pen. II (1907) 194 et Fl. Mal. Pen. V (1925) 52 pro parte.

? *C. insignis* Griff. *sensu* Ridl., Mat. cit. II (1907) 193 et Fl. cit. V (1925) 51 quoad specimina johorensia infra citata.

Stem 20–22 mm. in diam. with sheaths; spines on leaf-sheaths stouter; flagellum about 2 m. long. *Leaves* 1–1·30 m. long, with about 5 leaflets on each side, often a semi-abortive leaflet at the apex; largest leaflet about 40 cm. long, but usually 25–30 cm. long, 6–8 cm. wide.

Tab. 47a. *Calamus spathulatus var. robustus (Ridley s.n.).*
A, Caudicis fragmentum. B, Frondis fragmentum apicale.

Female spadix more robust and longer than in the type; secondary spathes smooth or sparingly spinulose. *Spikelets* 6–8 cm. long with 12–18 flowers on each side. *Fruit* 15 mm. long; scales in 18 series, pale yellow with faint rusty-brown margin; albumen equable; embryo basal.

MALAYA: Perak, Gunong Malacca (Kunstler 7,136, holotype). **Johore,** Gunong Pulai (Ridley 12,201 partly, & s.n.).

Ridley's unnumbered specimen from Gunong Pulai (cited here with some doubt) is probably from a young vigorous plant bearing leaves and flagella. The stem is thick, 2 cm. or more in diam.; the spines on the sheaths and petiole-bases are very short and swollen at the base; the leaves which are sessile or almost so, are about 60 cm. long (according to an estimate made from one leaf), and the basal leaflets are quite small. Its leaflets are as in the type of the variety, though slightly smaller. The absence of a definite petiole to the leaf might have been considered a character sufficient to separate this specifically from *C. spathulatus* var. *robustus*, but the length of petiole is very variable not only in *C. spathulatus* but also in a more or less similar species, *C. insignis*, depending upon the age of the plant.

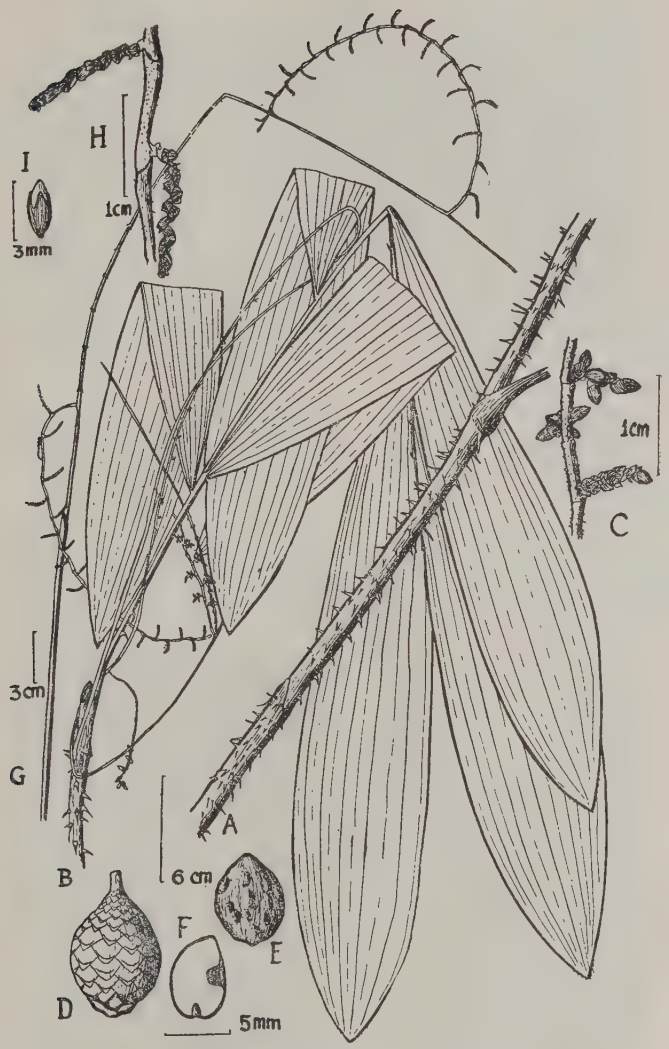
It appears that var. *robustus* is a montane form of *C. spathulatus*. Ridley 12,201 has been included here for geographical reasons only; it has neither the sheaths nor the lower portion of the leaf. Apparently it was collected at the same time as the other unnumbered specimen and may be from the same plant. Alvins 253 cited under *C. spathulatus* appears to be a transition stage between the var. *robustus* and the type taxon.

Ridley made this variety the basis of his *C. subspathulatus*, for which the holotype of this variety and two other collections were cited as syntypes. I have not seen the syntype from Kinta, but Curtis 3,161 (the third syntype) is obviously *C. insignis*.

48. Calamus filipendulus Becc. in Hook. f., Fl. Brit. Ind. VI (1892) 443; Ridl., Mat. Fl. Mal. Pen. II (1907) 193; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 188 t. 45; Ridl., Fl. Mal. Pen. V (1925) 51; Furtado in Gard. Bull. Straits Settl. VIII (1935) 249—**t. 48.**

C. pauciflorus Ridl., op. cit. V (1925) 57.

Stem tufted, scandent, 1·5–3 cm. in diam., all exposed vegetative parts drying dark-brown. *Leaf-sheaths* gibbous above, armed with scattered or slightly confluent, triangular, 5–10 mm. long spines. *Leaves* 50–100 cm. long; petiole 5–15 cm. long armed with solitary, short, 5–6 mm. long spines along the margins and the dorsum; rachis armed along the dorsum with remote simple or digitate, 2–5 mm. long claws. *Leaflets*, the terminal pair united to form a large, bifid flabellum; others 1–3 on each side of the rachis, subopposite or alternate; the mesial the largest 30–38 cm. long, 6–8 cm. broad, 7–9 costate,



Tab. 48. *Calamus filipendulus (A–F: Furtado 33,091; G–I: Id. 33,091[a]).*

A, Caudicis fragmentum ut vaginae armatura appareat. B, Id. cum folio et spadice femineo. C, Spadicis fragmentum feminei ut spathae secundariae et spiculae cum earum notis appareant. D, Fructus. E, Semen. F, Idem verticaliter discissum. G, Spadix masculus. H, Spadicis pars masculi ut spathae secundariae et spiculae cum earum notis appareant. I, Flos masculus.

unarmed on both sides, shortly setose on the margins except towards the base. *Spadix* male and female similar, filiform, 1–2 m. long, with 1–6 remote, 10–20 cm. long, spikelet-bearing branches. *Primary spathes* tubular, the basal one almost unarmed, the others clawed; the secondary spathes scabrid or densely aculeolate, striate. *Spikelets*, female 4–6 cm. long; male much smaller. *Fruiting perianth* explanate with a subcallous base; corolla 2½ times longer than the calyx. *Fruit* small, conical, ovate, rostrate, 10–12 mm. long, 6–8 mm. in diam,; scales straw-coloured with a brown intramarginal line and with whitish scariose margins; seed with equable albumen.

MALAYA: Perak, Tapah (Burkill & Haniff 13,451 & 13,446; isosyntypes of *C. pauciflorus*; Furtado 33,091 & 33,091[a], Haniff 14,252). **Pahang,** Telom (Ridley 13,921). **Selangor,** Rawang (Ridley 7,891).

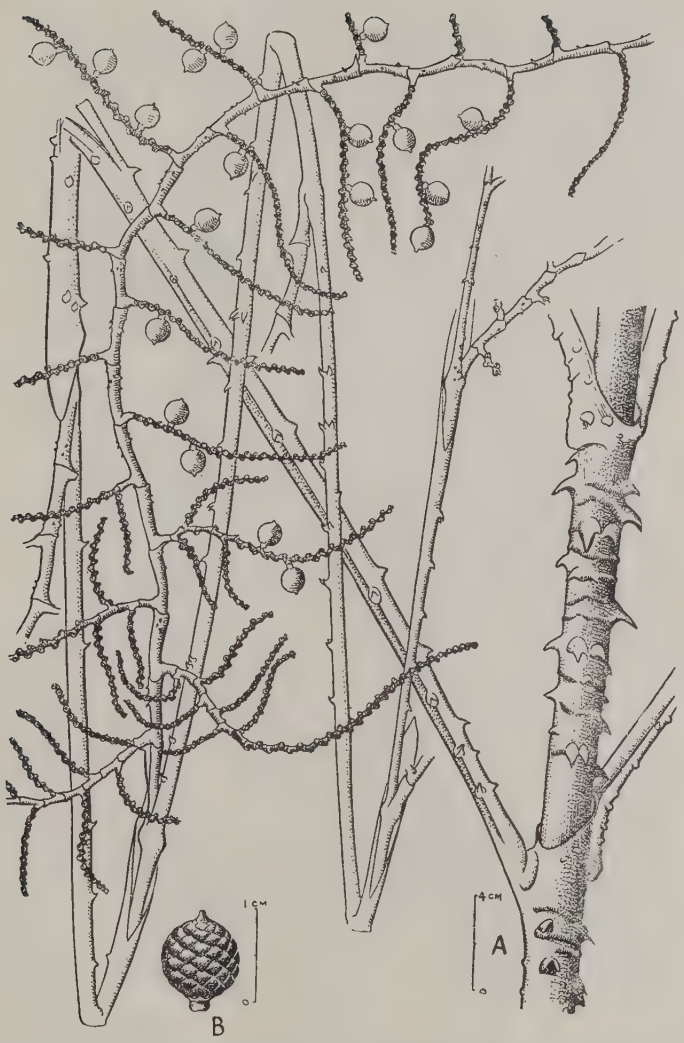
The plant grows in tufts. Beccari (1908) mentions leaves having up to 8 leaflets in all, but I have seen leaves with up to seven leaflets. *C. pauciflorus* is identical with this species (Furtado l.c.).

49. Calamus speciocissimus Furtado **spec. nov.—t.t. 49 & 49a**

C. palustris Griff. *sensu* Ridl. Mat. Fl. Mal. Pen. II (1907) 206 et Fl. Mal. Pen. V (1925) 61 quoad specimina Alvinsiana infra citata.

C. Scipionum *affinis, sed caudicibus gracilioribus; vaginis frondium rugas obtusas ferentibus; frondibus brevioribus; foliolis brevioribus, subequalibus, per frondem paucioribus, doubus apicalibus plerumque basi connatis, haec species sat distincta.*

Caudex scandens circa 25 m. longus, in omnibus partibus coffeatus, circa 2 cm. in diam. *Vagina* lineis plus minusve horizontalibus nigris ornata, aculeis ad 15 mm. longis triangularibus, reflexis, solitariis, basi superne tumescentibus interdum lateraliter confluentibus, inferne concaviusculis armata, striata, in senectute rugosa, infra petiolum valide gibbosa, apice truncata, secus margines inermis vel parce armata. *Ocrea* coriacea brevissima, vix visibilis. *Frondes* cum petiolo brevi 65–100 cm. longae, haud cirriferae, in foliola untrinsecus 9–10 divisae, petiolis, rachide, foliolisque in siccis omnino coffeatis; petiolus circa 6–9 cm. longus, semi-teres, supra applanatus, late concaviusculus, inermis, subtus secus margines aculeis 3–4 mm. longis obtusis in una serie dispositis, dorso verrucis vel aculeis conformibus haud pungentibus praedita; rachis dorso unguibus, basin versus simplicibus per 1–3 series dispositis, apicem versus plerumque 3-digitatis ornata. *Foliola* utrinsecus 9–10 opposita vel fere, elliptica, circa 6-costulata, costis omnibus apicem attigentibus, utrinque inermia, apice penicellata, nervis transversalibus conspicuis, maxima circa 30–35 cm. longa, 6–7 cm. lata, duo apicalia connata, vel rasissime libera, altera foliola subaequalia. *Spadices feminei* flagelliformes, frondibus longiores, bimetrales vel longiores, in 7–10 inflorescentias partiales divisi, parte pedunculari circa 50 cm. longa duas spathas ferente, apice in appendicem exeuntes; inflorescentiae partiales ad 60 cm. longae, apicales minores, in spiculas 6–12 cm. longas, vel basin versus in ramos secundarios spiculiferentes (spiculis ad 3 cm. longis), divisae. *Spathae primariae* tubulosae, spatha basale bicarinata excepta, cylindricae, unguibus validis ad 10 mm. longis nigrescentibus praeditae, apice oblique truncatae, 25–40 cm. longae; spathae secundariae infundibuliformes, aculeolatae, apice oblique truncatae, 2–2·5 cm. longae. *Spiculae* ad apicem spatharum orientes, alternatae, reflexae, 6–12 cm. longae, utrinsecus flores 20–25



Tab. 49. *Calamus speciosissimus (Corner 30,364—holotypus).*
A, Caudicis pars cum spadice et vaginis frondium. B, Fructus.

Tab. 49a. *Calamus speciosissimus (Corner 30,364—holotypus).*
A, Frons ut foliola et racheos armatura et eorum dispositio appareant.

gerentes (spiculis secundariis ad basin spicularum interdum orientibus minoribus circa 3 cm. longis); spathellae circa 3 mm. longae, infundibuliformes, striatae, apice scariosae, valide ligulatae. *Involucrophorum* paulo exsertum, haud conspicue pedicellatum, cupuliforme, ad apicem spathellae oriens; involucrum pateriforme, unilateraliter exsertum; areola lunata. *Perianthium fructiferum* urceolatum, conspicue pedicelliformi, basi truncatum, callosum; calyx apice irregulariter breviterque fissus, corollae aequi-altus. *Fructus* immaturus tantum visus, cum rostro circa 1 mm. alto, 10 mm. altus, 8 mm. in diam., oblongus; squamis concoloribus, leviter coffeatis, politis, per series verticales 15–18 dispositis, dorso canaliculatis, apice scariosis. *Spadix masculus* pro majore parte femineo similis ut videtur, ramis spadicis primariis vel secundariis spiculas ferentibus; spathis primariis haud visis; spathis secundariis minus armatis vel fere inermibus.

Stem long, scandent, about 2 cm. in diam. *Leaf-sheaths* gibbous above, marked horizontally with black rugose lines, armed with up to 15 mm. long, reflexed, solitary or laterally confluent spines. *Leaves* including the 6–9 cm. long petiole 65–100 cm. long, non-cirriferous, having 9–10 leaflets on each side; spines on the rachis solitary or digitate. *Leaflets* opposite or nearly so, elliptic, about 6-costate, unarmed on both surfaces, the largest 30–35 cm. long, 6–7 cm. broad, the terminal two connate at the base, rarely free. *Female spadix* long-peduncled, flagelliform, much longer than the leaves, with 7–10 branches, each up to 60 cm. long. *Primary spathes* tubular, 26–40 cm. long, clawed; secondary spathes 2–2·5 cm. long, aculeolate. *Spikelets* 6–12 cm. long, rarely shorter; spathels striate, ligulate. *Fruiting perianth* conspicuously pedicelliform, shortly lobed. *Fruit* (immature) 10 cm. long, 8 mm. in diam., with concolorous, coffee-coloured scales, disposed in 15–18 vertical series. *Male spadix* more or less similar to the female.

MALAY PENINSULA: Kemaman, Bukit Kajang, alt. 500 ped. (Corner 30,364, femineus-holotypus). **Malacca,** Chabau (Alvins 2,100 masculus, vern. nom. *Rotan Kubang*). **Negri Sembilan,** Bukit Sutu in Sungai Ujong (Alvins 1,883, masculus, vern. nom. *Ratan Suga Badak*).

Corner notes that this species is "a most handsome and beautiful rotan in its rich dark green colour, graceful inflorescences and amenable spines."

This species was confused by Ridley with *C. palustris* which belongs to a section having non-flagelliferous leaf-sheaths and conspicuously cirriferous leaves (Section Phyllanthectus or Group XV of Beccari). *C. speciosissimus* belongs to the Coleospathus section, being a close ally of *C. Scipionum*; in fact the spadices and the fruits are very like those of *C. Scipionum*, from which however *C. speciosissimus* differs in the following characters: less thick stems; wrinkled leaf-sheaths, shorter leaves, leaflets subequal and fewer to a leaf, the terminal pair of leaflets being generally connate at the base. The vertical series of the fruit-scales also vary from 15 to 18.

C. speciosissimus bears involucrophores which are somewhat raised on the upper side and the involucres which are exsert on one side giving thereby an appearance of subpedicelliform involucrophores.

50. Calamus ornatus Bl. var. **horridus** Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 460 et in Ann. Roy. Bot. Gard. Calc. XI (1908) 368 et Suppl. (1913) 73.—**t. 50.**

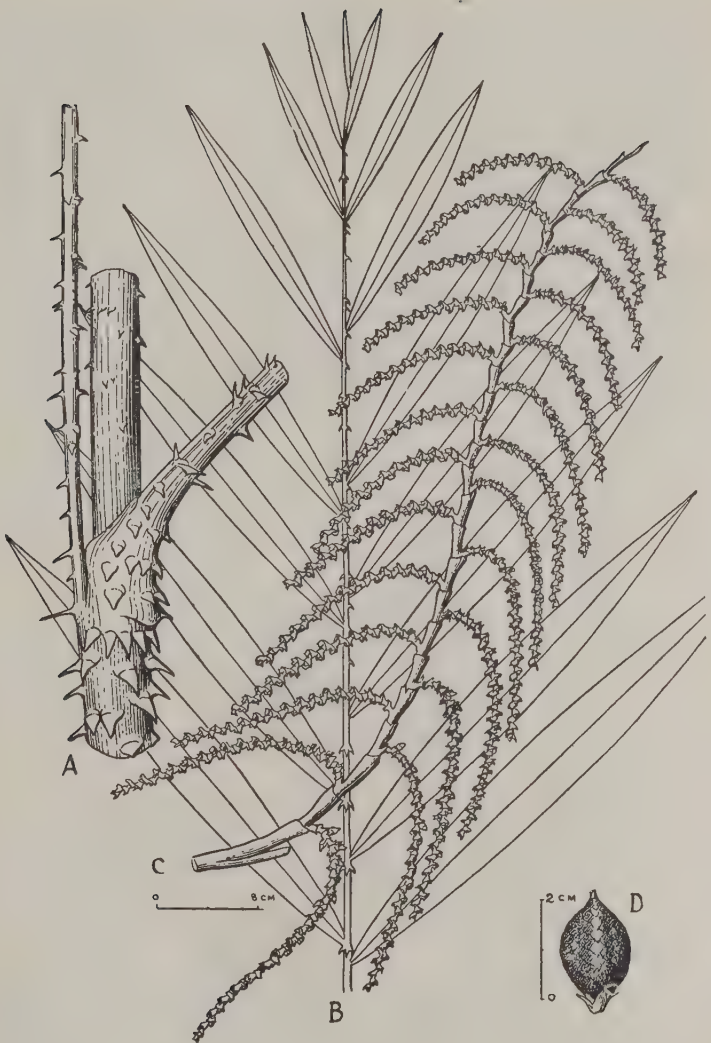
C. ornatus Bl. var. *sumatranus* Becc. in Rec. Bot. Surv. Ind. II (1902) 215 (nomen tantum), in Ann. cit. XI (1908) 369 pl. 153. **syn. nov.**

C. ornatus Bl. *sensu* Griff. in Calc. Journ. Nat. Hist. V (1844) 37 et Palms Brit. Ind. (1850) 46; Miq., Palm. Sum. in Journ. Bot. Neerl. I (1860) 21 et Prodr. Fl. Sum. (1860) 256; Ridl., Mat. Fl. Malayan Pen. II (1907) 196 et Fl. Malay Pen. V (1925) 54 (omnino pro parte).

Stem tufted, lofty, scandent, 40 m. long or more, 4–8 cm. in diam. *Leaf-sheaths* woody, obliquely truncate, gibbous below the petiole, fugaciously furfuraceous, light straw-coloured, armed with broad flat, triangular, light coloured, solitary or confluent, horizontally or obliquely placed, up to 4 cm. 1·5 cm. broad at the base, spines. *Ocrea* short. *Leaves* subcirriferous in the adult and fertile stages, 4–6 m. long including the petiole; rachis irregularly armed along the middle and the sides with simple or binate claws, which become 3–4 in the terminal parts; petiole stout, 45–80 cm. long, armed beneath and above with unequal and irregularly placed spines. *Leaflets* numerous, equidistant, elongate-lanceolate, alternate, plicate, 5-costate, glabrous or sparingly spinulous on the 1–5 costae above, naked and paler beneath, largest about 60–80 cm. long, 5–8 cm. broad, the upper leaflets gradually smaller becoming diminutive at apex. *Female spadix* robust, flagelliform, 1·5–3 m. long, terminating in a strongly clawed flagellum and divided in 3–4 remote 45–80 cm. long spikelet-bearing branches. *Primary spathes* closely sheathing, tubular, coriaceous, truncate, shortly ligulate, armed irregularly with short or confluent spines, or practically unarmed in parts; secondary spathes tubular, 10–25 cm. long, truncate, slightly ligulate at the mouth, unarmed. *Spikelets* robust, 10–20 cm. long with 10–20 female flowers on each side; spathels broadly infundibuliform, entire, truncate, slightly apiculate, fugaciously furfuraceous. *Involucrophore* nearly inserted, cupular; involucre partly exsert, unilaterally cupular, with very sharply bordered ovate areola on the most exsert side. *Fruiting perianth* distinctly pedicellate. *Fruit* large, ellipsoid or ovoid elliptic, rostrate, 3–3·5 cm. long, 2–2·2 cm. through; scales black, or dark brown in parts, channelled in the middle, disposed in 15 vertical series; seed 15–20 mm. long, 12–15 mm. broad, 6–8 mm. thick, with homogeneous albumen, embryo basal. *Male spadix* not seen but described as ultra-decompound with many branches.

MALAYA: Kemaman, Ulu Bendong at Kajang, alt. 160 m. (Corner 30,173). **Kedah,** Tanjong Parit in the Baling District (Furtado 33,072, vern. nom. *Rotan Semambu Ganga* and *Rotan Manau*). **Kelantan,** Gunong Musang (Henderson 22,716). **Pahang,** Bentong near Raub Boundary, alt. 600 m. (Furtado 33,101, vern. nom. *Rotan Manau*). **Perak,** Temango (Ridley 14,718). **Selangor,** Kepong (Junus 16,403 as *Rotan Mantang*). **Singapore,** Bukit Timah (Ridley 11,481).

The syntypes of *C. ornatus* var. *horridus* were collected at Durian Tungul in Malacca by Fernandez, and in Perak by Scortechini (No. 587[b]) and by Kunstler (No. 3,931). The type of *C. ornatus* var. *sumatranus* was collected by Beccari (P.S. No. 833) at Ayer Manchor in the Padang Province of Sumatra. I have seen



Tab. 50. *Calamus ornatus var. horridus (Furtado 33,072).*

A, Caudicis fragmentum ut vaginae et petioli armatura appareat. B, Frondis fragmentum apicale. C, Spadicis ramus feminei spiculiferens. D, Fructus.

none of these types, and my identification of the varieties have been based entirely on the descriptions and Beccari's plate 153. I am unable to separate with clear cut distinctions, the Malayan from the Sumatran material illustrated and described by Beccari; further there is a good deal of variation in the Malayan material itself to justify the reduction of var. *sumatranus* to var. *horridus*. From the description and illustrations, I cannot accept Ridley's reduction of the Malayan material to *C. ornatus* var. *ornatus* which is a Javanese form.

The species is tufted and produces a long cirrus at the end of the leaves of juvenile climbing plants, even when these start bearing flowers and fruits. Corner 30,173 has a 4–7-foot long cirrus even when the specimens bear flowers and young fruits, though he notes that the cirrus is often absent in the upper leaves. In the specimens collected by me (Furtado 33,072 and 33,101) the leaves have no long cirrus. The involucre is so exsert in the species that it gives the false impression that the involucrophores are pedicelliform.

The vernacular name recorded by Fernandez in Malacca is stated to be *Rotan Ruga Bodak* which may be a misprint for *Rotan Segar* (or *Suga*) *Badak*. Scortechini gives *Rotan Mantang* as the vernacular name in Perak.

51. Calamus Scipionum Lour., Fl. Cochin. ed. 1 (1790) 210; emend. Becc. in Hook. f., Fl., Brit. Ind. VI (1893) 461; et in Rec. Bot. Surv. Ind. II (1902) 215; Ridl., Fl. Malayan Pen. II (1907) 195; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 371 tt. 156, et Suppl. (1913) 74; Ridl., Fl. Malay Pen. V (1925) 52; Blatter Palm Brit. Ind. & Ceylon (1926) 332 pl. LVI.—**t. 51.**

C. micranthus Bl., Rumphia III (1849) 53 (33) t. 151 (157) as to the leaves only.

Calamus from Ching (Malacca), Griff. in Calc. Journ. Nat. Hist. V (1844) 37 et Palms Brit. Ind. (1850) 46 (note).

Daemonorops fissus Bl. op. cit. (1849) 17 t. 44 figs A.B.C. and as to the leaves only.

Stem tufted, very long, scandent, 3–6 cm. in diam., (1·5–3 cm. through without sheaths), the internodes in some cases nearly a metre long. *Leaf-sheaths* glabrous, gibbous above, armed with simple, occasionally approximate spines; the latter reflexed or nearly horizontal, laminar, 1–3 cm. long. *Ocrea* short, less than 1 cm. long, scarious, brittle, deciduous. *Leaves* 1·5–3 cm. long, not cirriferous, ending in one or two central, diminutive leaflets; petiole 20–75 cm. long, 1·5–2·5 cm. broad, unarmed above, clawed or not along the dorsum, sparingly armed along the margins; rachis irregularly clawed on the dorsum, claws simple in the basal half, digitate and whorled in the upper half.

Tab. 51. *Calamus Scipionum (Ridley sn. ex Horto Singaporensi).*

A, Petiolus cum geniculo et basi flagelli. B, Frondis fragmentum apicale. C, Spadicis pars cum ramo spiculiferenti. D, Spadicis apex. E, Fructus. F, Ejusdem perianthium. G, Semen. H, Idem verticaliter discissum.

Leaflets numerous, alternate or subopposite, equidistant, 5–10 cm. apart, closer and shorter in the distal ends, lanceolate, 3–5 or 7 costulate, 2–4 nerves bristly in the centre and distal half of the upper surface, occasionally spinulous on the midrib on the lower surface, ending in a bristly penicillate apex, drying coffee or cinnamon coloured, the largest 50–70 cm. long, 5–9 cm. wide, the terminal ones much smaller. *Female spadix* flagelliform, 4–7 m. long, divided into 6–9 branches, terminating in a long, clawed flagellum. *Primary spathes* tubular, closely-sheathing, entire, the largest about 30–50 cm. long, the basal bicarinate, the others cylindrical, somewhat narrowed at the base, armed with solitary or digitate claws. *Partial inflorescences* 1–1·50 m. long, bearing 10–20 alternate spikelets on each side. *Secondary spathes* 3–4 cm. long, rather loosely sheathed, unarmed or armed with short reflexed spines, obliquely truncate and ligulate at the apex, ciliate on the margins. *Spikelets* 8–18 cm. long, one-sided, funnel shaped, striate, ciliate on margins, with a ligulate apex. *Involucrophore* prateriform at the mouth of the spathels; involucre disciform, slightly exsert on one side. *Female flowers* about 4 mm. long, ovoid. *Fruiting perianth* pedicelliform, corolla slightly longer than the calyx. *Fruit* ovoid or oblong, 12–14 mm. long, 8–10 mm. through, abruptly narrowed at both ends; scales in 15 series, dark brown with pale margins; seed with superficially ruminated albumen; embryo basal. *Male spadix* similar, but less robust, and smaller in parts, less clawed or aculeate; spikelets 1-5–3 cm. long, borne on secondary branches; flowers pectinate or alternate, 3 mm. long, calyx striate, lobed half way, half as long as the corolla.

MALAYA: Perak, Gunong Malacca (Kunstler 7,171); loc. incert. (Scortechini 501b). **Selangor,** Batu Tiga (Curtis 3,765 as *Rotan Semembu*); Kuala Lumpur (Ridley 1,661 as *Rotan Rajah*). **Malacca,** cult. in Hort. Bot. Sing. (Ridley 11,618; 11,838; & 13,339). **Negri Sembilan,** Kuala Pilah (Moorhouse in 1903). **Penang** in Hort. Bot. Cult. (Curtis 27 Nov., 1902). **Singapore,** Economic Garden (Nur 517 and Ridley s.n.).

BORNEO: Sambas, cult. in Hort. Bot. Bogor. sub. n. XII C. 146 (Furtado 30,904); Semporna (Keith 7,436 partly as *Rotan Semambu* in Malay and *Malaw* in Suluk dialect).

DISTRIBUTION: Sumatra and Billiton.

Though this species is widely known from the walking-sticks made out of its stems, yet for nearly a century its botanical identity was obscure and confused. The original description itself is valueless for the correct identification of the species, being based, in its important characters, on the walking-sticks of the commerce, deriving its characters of leaf and other parts on fragments or pictures which apparently do not belong here. Later good specimens of this species were either misidentified or left unnamed. We owe therefore to Beccari (1893) for the present typification of the species and for clarifying the confusion by naming the specimens in different important herbaria of the world. According to this typification the name is retained for the large Malacca cane of commerce of which Loureiro had written thus: *"Caulis crassus . . . articulis 3-pedalibus . . . Habitat imprimis in sylvis malajorum, ex utraque parte freti Malaccensis; unde abundanter in Sinas, et in Europam exportatur . . . Pro baculis ex dignitate, vel elegantia manu gestandis."*

The species being a tufted plant is able to maintain itself despite the fact that it is often cut for commercial purposes. No doubt there are other *Calami* which furnish walking-sticks, but those of *C. Scipionum* are undoubtedly the best and commonest having the longest internode. The plant is widely exploited in Sumatra and it is not unreasonable to suppose that its distribution is effected in some measure through the planting in the jungles by men.

There is a good deal of variation in this species regarding the disposition of spines and leaflets, and it is possible that a great many of these variations are dependent on the age of the clump as well as the individual stem. A young specimen collected by Moorhouse on 24–XII–1903, as *Rotan Machap* apparently belongs here.

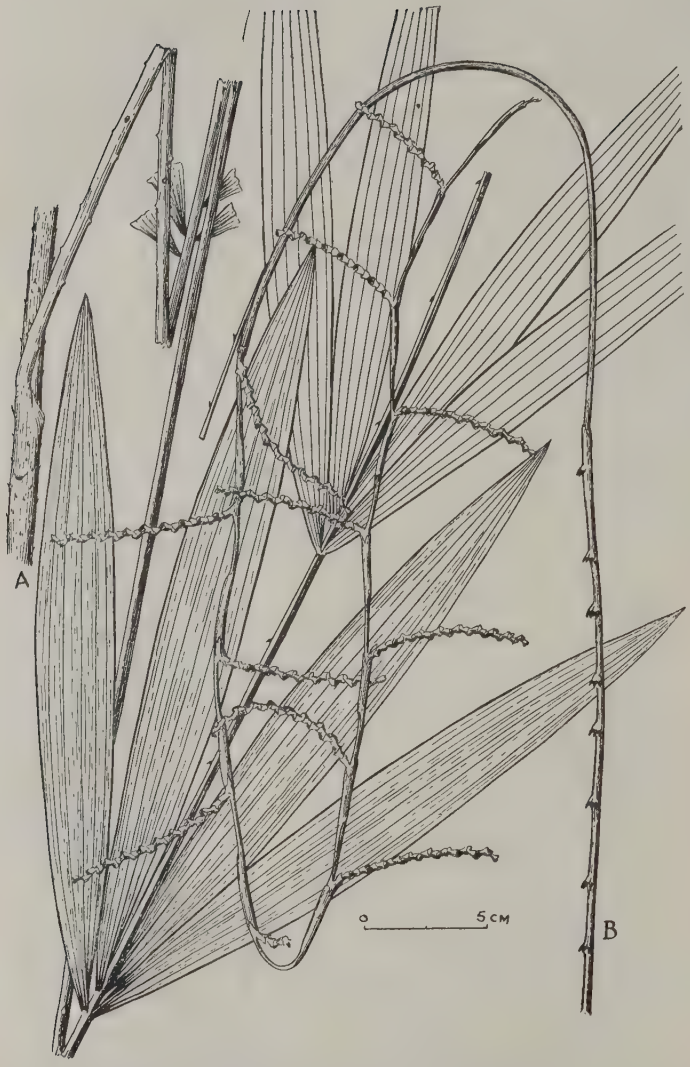
52. Calamus Moorhousei Furtado **sp. nov.—t. 52.**

C. caesius sensu Ridl., Mat. Fl. Malayan Pen. II (1907) 205 et Fl. Malay Pen. V (1925) 60 quoad specimen infra citatum.

A C. poensi, *cui affinis ut videtur, differt petiolis longioribus, ocreis minoribus, aculeis vaginae frondalis minoribus paucioribusque, foliolis per greges binis.*

Caudex scandens, gracilis, cum vaginis circa 1·5 cm. in diam. *Vagina* frondis flagellifera, brunnea, striato-sulcata, aculeis ascendentibus haud rigidis concoloribus laminaribus, usque ad 5 mm. longis praedita, infra petiolum leviter gibbosa, in gibbo valde striata parce aculeolata vel inermis, apice oblique truncata. *Ocrea* inermis, brevis, vix visibilis. *Frondes* ultra metrales, haud cirriferae; petiolus unicus visus, 29 cm. longus, biconvexus, supra aculeolis brevissimis irregulariter praeditus, secus margines utrinque aculeolis 1–3 mm. longis, 3–4·5 cm. inter se remotis ornatus, subtus politus, gramineus, aculeolis usque ad 4 cm. deflexis, solitariis, 7–8 inter se remotis armatus; lamina sine apicem visa, 75 cm. longa, secus rachidis dorsum trigonalis politae aculeis 1–3 fidis remotis reflexis armata. *Foliola* in greges oppositos vel fere, 20–25 cm. inter se remotos fasciculata, per gregem in rachide utrinsecus bina, inter se divergentia, 18–20 cm. longa, ad 4 cm. lata, elliptico-lanceolata, porrecta, secus margines setosa, supra secus costam medianam tantum apicem versus setosa, subtus inermia, costis alteris et nervis transversalibus haud validis. *Spadix femineus* flagelliformis, frondibus longior ut videtur, axi stramineus, aculeolatus; inflorescentiae partiales circa 50 cm. longae remotae, spiculis utrinsecus circa 6–7 praeditae. *Primariae spathae* tubulosae, stramineae, aculeis simplicibus vel 1–3 digitatis, reflexis, apice atris praeditae; spathae secundariae 3–4 cm. longae, inermes, elongato infundibuliformes, *Spiculae* 4–8 cm. longae, floribus utrinsecus 7–10, alternatis; spathellae 3–4 mm. longae, infundibuliformes, deciduo fusco-leprosae, apice breviter ligulatae vel non. *Involucrophorum* ad spathellae orificium oriens, cupuliforme; involucrum cupuliforme; areola lunata. *Fructus* ignotus.

Stem scandent, slender, about 1·5 cm. in diam., moderately long. *Leaf-sheaths* slightly gibbous above, striate, flagelliferous, obliquely truncate, armed with scattered solitary, up to 5 mm. long, ascendent, non-rigid spines. *Leaves* apparently not cirriferous, about 1 m. or more long; petiole, only one seen, 29 cm. long, biconvex, polished beneath, where it is armed along the middle and in the margins with a few remote, solitary short spines; rachis armed beneath with weak claws



Tab. 52. *Calamus Moorhousei (Moorhouse s.n.—holotypus).*
A, Caudicis fragmentum cum folio. B, Spadix incompletus.

which are simple in the lower half and digitate in the upper. *Leaflets* fascicled, 18–20 cm. long, about 4 cm. broad, elliptic lanceolate, setose on the median nerve above and on the margins, naked beneath; fascicles of 2 divergent leaflets, opposite, 20–25 cm. apart. *Female spadix* very long, flagelliform, with about 50 cm. long, pendulous branches, bearing 4–8 cm. long spikelets; all parts straw coloured in the dry state. *Primary spathes* tubular, long, clawed; secondary spathes tubular, 3–4 cm. long, unarmed, straw-coloured; spathels 3–4 mm. long, fusco-leprous, unarmed.

MALAYA: Negri Sembilan, Kuala Pilah (Moorhouse in 1905).

The specimen does not appear to be from a fully developed plant and the weak spines on the leaf-sheaths and the slightly developed gibbosity seem to confirm this.

C. Moorhousei has been confused by Ridley with *C. caesius,* from which it is readily distinguished by its slender, less aculeate stems, longer petioles, flagelliferous leaf-sheaths, fewer leaflets (which are moreover arranged in opposite pairs), ecirriferous (apparently) leaves, long flagelliform spadices and narrower primary and secondary spathes. *C. caesius* is a species of the section *Phyllanthectus.*

53. Calamus viminalis Willd. var. **fasciculatus** (Roxb.) Becc. subvar. **pinangianus** Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 207.

C. viminalis var. *fasciculatus* (Roxb.) Becc. in Hook. f., Fl. Brit. Ind. VI (1892) 444 et in Rec. Bot. Surv. Ind. II (1902) 203 quoad specimen penangense.

C. viminalis var. *pinangianus* (Becc.) Becc. in Ann. *cit.* Appendix (1913) 21 (sphalmate ?).

Stem tufted, scandent, 10–15 m. long, 2–3 cm. in diam., all parts acquire on drying a straw colour. *Leaf-sheaths* flagelliferous, gibbous above, armed with flat, broad-based, horizontal or slightly deflexed spines. *Leaves* non-cirriferous, about 1 m. or more long; petiole short, 9–20 cm. long, armed at the sides, and sometimes in the middle beneath and above, with long spines; rachis armed on the lower surface along the margins and the middle with 1·4 cm. long, simple or geminate or ternate spines, the marginal spines lacking on the terminal parts of the leaves, and occasionally armed on the upper surface with long, solitary spines at the basal end of the rachis. *Leaflets* many, pointing in many directions, arranged in distant, alternate or opposite fascicles of 2–4 each; the largest leaflets about 30 cm. long, 2·5–2·8 cm. broad, spinulous on the nerves on both surfaces and along the margins. *Female spadix* about 2 m. long, flagelliform, divided into 5–6 cm. partial inflorescences, each bearing 3–6 spikelets on each side; spikelets 6–12 cm. long. *Primary spathes* long, tubular, aculeate or clawed; secondary spathes 1·5–2 cm. long, tubular, unarmed, apiculate. *Fruit* sphaeric, 8–9 mm. in diam.; scales straw-coloured with brown tips, arranged in 18–20 (?) series; seed with equable albumen. *Male spadix* like the female, but with longer branches and spikelets, and with flowers at each spathel being arranged in glomerules.

MALAYA: Penang (Wallich 8,611).

Tab. 53. *Calamus concinnus* ♂ *(Ridley 15,360).*

A, Petioli fragmentum basale. B, Folii fragmentum apicale. C, Spadicis pars masculi. D, Flos masculus. E, Idem apertus ut staminum dispositio appareat.

C. viminalis has a wide range of distribution occurring in Java, Bengal, Burma, Andamans, Malaya and Cochin-China. The varietal name *fasciculatus* has been adopted by Beccari for all the non-Javan forms. The subvar. *pinangianus* is not known except from the holotype collection cited above. As no subsequent material of this variety was collected, Ridley (Mat. Fl. Malayan Pen. II, 1907 p. 213 was of the opinion that *C. viminalis* in any form did not occur in Penang, as the following remarks show:—

"This has never been seen again in the peninsula and is an Indian species; the locality is probably erroneous".

Beccari's remarks on this opinion of Ridley are as follows:—

"We may however also suppose that the plant has been destroyed in Penang, as the presence of this plant could not be considered an extraordinary fact, considering that *C. viminalis* with its numerous varieties is not a localized Indian plant, but a rather widely diffused species in Southern Asia and Java" (op. cit. 1913 p. 21).

However Ridley has not included this species or the subvariety in his Flora (1925).

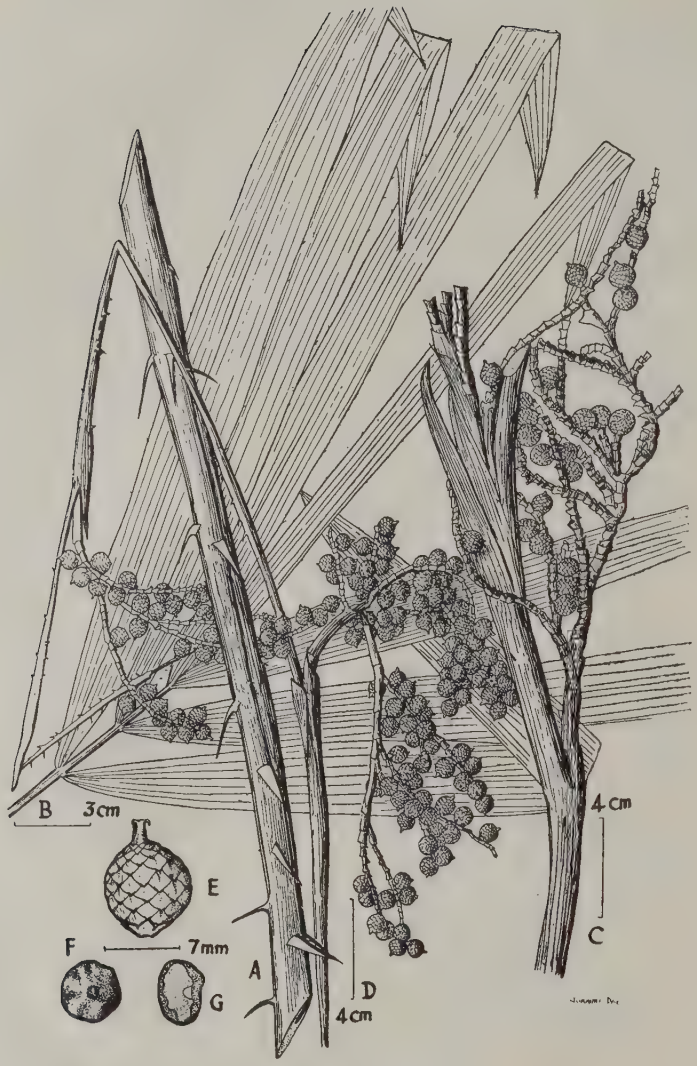
This species is readily distinguished from *C. siamensis* in its leaflets which spread in all directions in each fascicle; whereas those of *C. siamensis* are all in one plane. *Female flowers* are also grouped in *C. siamensis*, not solitary as in the vars. of *C. viminalis*.

I have not seen the type specimen of this subvariety, and the description given above is drawn mainly from Beccari's description of *C. viminalis* supplemented by the notes given by him under the subvariety. From the characteristics noted by me in the specimens of the non-Malayan material in the herbarium, it appears that the size of the leaflets vary a good deal according to the age of the individual and the clump and so the range of variation within the varieties and the subvarieties have to be studied further. The Malayan species, *C. siamensis* and *C. Burkillianus* are very close relatives of *C. viminalis*.

54. Calamus concinnus Mart., Hist. Nat. Palm. III ed. prior (1838) 208 ed II (1850) 332, et (1837) t. 116 fig. X; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 201 t. 60; Ridl., in Journ. Roy. Asiat. Soc. Straits Br. 59 (1911) 217; Becc. op. cit. Appendix (1913) 21; Ridl., Fl. Malay Pen. V (1925) 50 pro parte.—**t.t. 53 & 54.**

C. multirameus Ridl., Mat. Fl. Mal. Pen. II (1907) 202 pro parte.

Calamus sp. Furtado (in observ. sub *Plectocomiopsis ferox* Ridl.) in Gard. Bull. Sing. XIII (1951) 338 t. 14.



Tab. 54. *Calamus concinnus* ♀ *(Henderson 23,125).*

A, Petioli pars. B, Frondis fragmentum apicale. C, Spadicis fragmentum basale. D, Spadicis fragmentum apicale. E, Fructus. F, Semen. G, Idem verticaliter discissum.

Plectocomiopsis ferox Ridl., Fl. Mal. Pen. V (1925) 66, **syn. nov.**

Stem acaulescent or erect (or later scandent?). *Leaf-sheaths* (of the scandent stems not seen), of the basal leaves opened on one side, armed with 3–5 cm. long, triangular, solitary or obliquely confluent spines; later or lower down the sheath the spines shorter, about 2·5 cm. long, 10–12 mm. broad at base narrowed into a long point. *Leaves* non-cirriferous, large, ending in one or two leaflets without any diminutive leaflet or cirrus; the basal ones provided with a long petiole; rachis armed below with solitary, 2–3 cm. long, deflexed spines. *Leaflets* numerous, grouped in large fascicles at least in the younger stages of the plant, equidistant in the fascicles, 2–3 cm. apart, greenish when dry, 30–60 cm. long, 3–3·5 cm. broad, ensiform. *Spadix* apparently large; female apparently tending to be flagelliform (in older and scandent plants?), ending in a clawed appendix, with about 20–30 cm. long branches (in female spadix seen), each branch with about 20 spikelets, borne on the secondary branches; the male spikelets being generally borne also on the secondary branches. *Primary spathes* tubular, scurfy, the basal ones unarmed or weakly armed, those towards the apex of the spadix being more conspicuously armed, all somewhat split towards the apex; secondary spathes unarmed, scurfy, marcescent at the apex. *Female spikelets* 10–16 cm. long in the basal portions of the spadix, gradually shorter in the apical portions; male spikelets much shorter. *Fruiting perianth* explanate, with the corolla lobes as long as, or sometimes slightly shorter and usually narrower than, the calyx lobes. *Fruit* 8–10 mm. long, 7 mm. in diam., subglobose, beaked; scales arranged in 15–18 series, straw-yellow coloured with brownish tips. *Seed* with equable, or with a slightly ruminate albumen.

MALAYA: Lower Siam; Kau Hoa in Surat (Seidenfaden 2,137). **Setul,** Bukit Rajah Wang (Ridley 15,360). **Perlis,** Bukit Ketri (Henderson 23,125). **Langkawi Islands,** Batten-Pooll in II–1940); Telok Apan (Haniff & Nur 7,087). **Perak** ? (Ridley 8,405 partly).

DISTRIBUTION: Tenasserim in Burma.

Martius stated that the type was collected by Wallich at Tavoy in the Tenasserim district of Burma; but from the subsequent citations it appears that the type was Gomez's collection distributed by Wallich under his Catalogue No. 8,607. I have not seen any representative of this collection, nor did Beccari who identified the species on Helfer 6,388, 6,394 & 6,395 from Mergui. I examined Helfer 6,394 and 6,395 in Kew and did not find on them any notes which, according to Beccari, show that the palm is climbing and "armed with strong and powerful spines." As represented in Kew the specimens could have been of a non-scandent palm. I have not seen Helfer 6,395 in Florence. What Beccari identified as being leaflets from Helfer 6,388 are mounted in Kew with a spadix of *C. Helferianus* in Helfer 2,763.

Parker 2,407, which was collected in 1927 by the Tenasserim River in Tavoy, Burma, and which is obviously *C. concinnus*, has field notes to show that the palm is stemless and bears no flagella or cirri on its leaves; the axis of the spadix and the primary spathes also bear short straight spines which are not adapted for climbing.

The Malayan material is too fragmentary for any definite conclusions to be drawn on this matter. Ridley 15,360 appears to be from almost a stemless palm and so also Henderson 23,125; but in the latter the spadix seems to be flagelliform in the upper portion and ends in a clawed appendix. In both these some of the primary spathes are aculeate, the spines being hooked in the uppermost primary spathe in Henderson 23,125. The terminal portion of the leaf in Ridley 15,360 definitely shows grouping of leaflets, but in Henderson 23,125, which is also a terminal portion of a leaf shows no such grouping. It is possible that the species starts flowering and fruiting when quite stemless and has fascicled leaflets, but that later the plants become scandent, the spadices flagelliform, and the leaflets equidistant. The species therefore requires further study, for which better specimens are needed.

Ridley 8,405 is mixed, containing a fruiting branch of the inflorescence of this species glued on to the sheet containing the male spadix of *C. multirameus*, a fact noted also by Beccari in the Appendix op. cit. (1913) pp. 21 & 49. In fact this fruiting branch appears to have been the sole basis of the description given by Ridley for the fruits and the spadix under *C. multirameus*. The other specimen bearing this same number contains leaf and sheaths of *C. multirameus*.

As Ridley would not accept Beccari's identification of the greater part of the specimen No. 8,405 as *C. Guruba* (a species closely allied to *C. multirameus*), he (1925) erroneously reduced his entire *C. multirameus* to *C. concinnus*, omitting to cite the locality of his No. 8,405. Since the fruiting portion of *C. concinnus* might have been placed through an error on the mounted sheath of Ridley 8,405, there remains some doubt as to the occurrence of this species in Perak.

Plectocomiopsis ferox Ridl., based on Haniff & Nur 7,087 from Langkawi, as represented in the Singapore herbarium (see plate 14 in Furtado, 1951), consists of a detached leaf-sheath, a portion of male spadix, and a portion of a leaf; the last mentioned is obviously from a leaf produced on the ground and so it is not easily compared with other specimens of the species. The rachis of this leaf has larger spines, and the setae on the leaflet-nerves and margins are also larger. But the spathes and the inflorescence are clearly of *C. concinnus*. The leaf-sheath has never been described before, and so it is not easy to say whether the one in Haniff & Nur 7,087 belongs to this species; if it does belong, it obviously illustrates the leaf-sheaths of a typical adult species when the stem has become somewhat scandent. The portions of the spadices suggest that the species may bear flagelliform spadices in later stages of the plant.

55. Calamus siamensis Becc. var. **malaianus** Furtado **var. nov. —t. 55.**

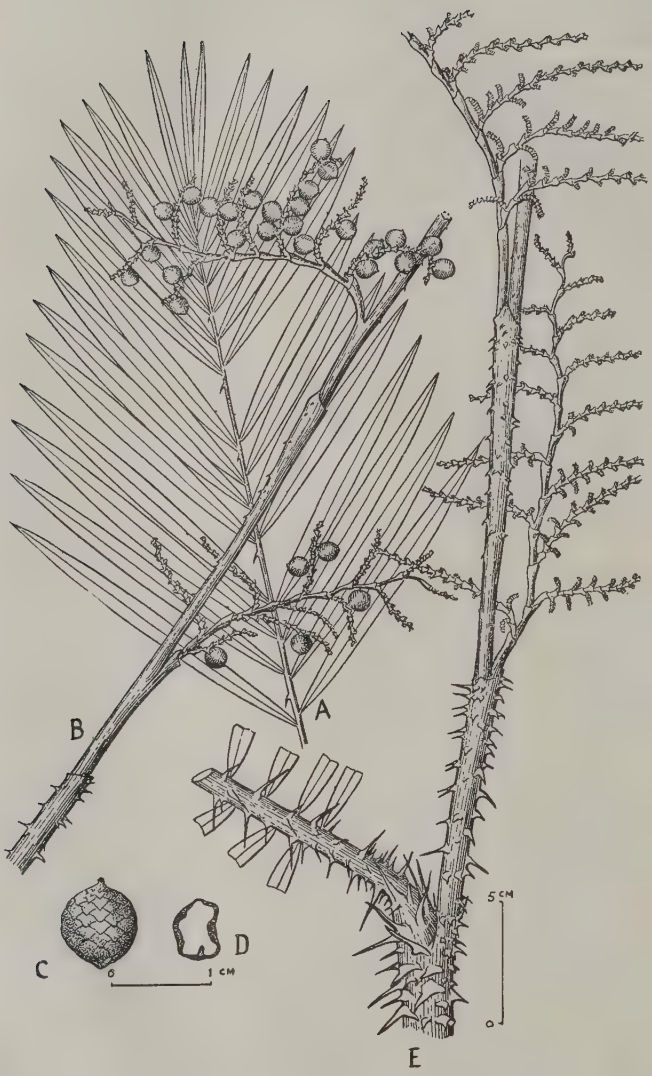
C. siamensis Becc. *sensu* Ridl., in Journ. Roy. Asiat. Soc. Straits Br. 59 (1911) 216 et Fl. Malay Pen. V (1925) 59.

C. densiflorus Becc. *sensu* Ridl., Fl. cit. (1925) 53 quoad specimen kedahense prope Langgar lectum.

Differt a forma typica foliolis obscure irregulariterque fasciculatis. A C. viminalis *var.* fasciculato, *quocum haec varietas facile confusibilis, foliolis parallelis haud divergentibus facile distinguenda.*

Stem tufted, scandent, 2–5 m. long, about 2 cm. in diam., all parts drying yellowish or straw-green. *Leaf-sheaths* flagelliferous, gibbous above, armed with many unequal, laminar, swollen and broad-based abruptly narrowed upwards, solitary or obliquely confluent, reflexed or sometimes horizontal spines, the largest spines 1·5–2 cm. long. *Ocrea* short, membranous, marcescent, deciduous, somewhat frimbrillate. *Leaves* non-cirriferous, about 60 cm. long including the 3·5–5 cm. long petiole; the latter flat above where it is armed with small, scattered spines (in young plants these spines may be absent), and along the sides and the back with many longer, horizontal or deflexed, narrower, sometimes as long as 2 cm. long spines; rachis spinulous above and along the margins below in the lower half, armed beneath with very unequal up to 20 mm. long, solitary or confluent, deflexed spines. *Leaflets* numerous, 30–35 on each side, all set in one plane, divided irregularly in opposite groups of 4–12 leaflets each side, 10–15 mm. apart in each group, rarely 2–2·25 cm. in the basal parts of the leaves, linear-ensiform, unicostate, suddenly acuminate at apex, midcosta setose on both surfaces, and the margins, and occasionally the two subprimary nerves beneath also bristly; the largest leaflets mesial, 15–27 cm. long, 15–17 mm. broad; the two terminal leaflets the smallest, more or less slightly connate at base. *Female spadix* flagelliform, much longer than the leaves, divided into 4–5 spiculiferous branches; the largest branch 8–12 cm. long, each having 5–10 alternate, 2·5–4 cm. long spikelets. *Primary spathes* strictly sheathing, tubular, obliquely truncate, armed with scattered, reflexed spines; secondary spathes unarmed, tubular, obliquely truncate, 10–15 mm. long; spathels broadly infundibuliform each bearing two female flowers. *Involucrophore* included in the spathel, bearing two cupuliform involucres at the end, one on each side of the apex, with an areola between the two involucres. *Fruiting perianth* explanate, calyx splitting down to the base. *Fruit* small, spherical, 6–8 mm. in diam.; shortly beaked, with an explanate perianth; scales channelled in the middle, disposed in 15–17 longitudinal series, straw-coloured with a whitish scarious marginal line and often with a reddish point; seed with white homogeneous albumen. *Male spadix* like the female, but with longer spikelets, the lower spikelets of the larger spadix-branches often bearing 1–2 cm. long secondary spikelets, and the male flowers arranged in glomerules of 3–5 at each spathel.

MALAYA: Perlis, Telor Jambu (Ridley 15,359 femineus, holotypus); Tebing Tinggi (Henderson, masculus, 23,028). **Kedah,** Langgar (Burkill et Haniff 13,313-masculus, vern. nom. *Rotan Pahit*); Bukit Pinang in Alor Star (Ridley in II–1910, masculus).



Tab. 55. *Calamus siamensis var. malajanus (A–D: Ridley 15,359—holotypus; E: Henderson 23,028 ♂).*

A, Frondis fragmentum apicale. B, Spadicis pars. C, Fructus. D, Semen verticaliter discissum. E, Caudicis pars cum spadice et basi petioli.

C. siamensis was based on a specimen collected by Schomburgh in Siam, the holotype being preserved in the Kew Herbarium; it was again collected in fruit at Bangkok by Wawra, the latter specimen being preserved in the Vienna Herbarium. Beccari, who examined both these specimens, described the species as having equidistant leaflets, not in groups, whereas the Malayan specimens have all leaflets disposed in groups. In each group the leaflets are equidistant and in one plane, not spreading in different directions as in *C. viminalis* var. *fasciculatus* subvar. *pinangianus.*

56. Calamus pandanosmus Furtado **sp. nov.—t. 56.**

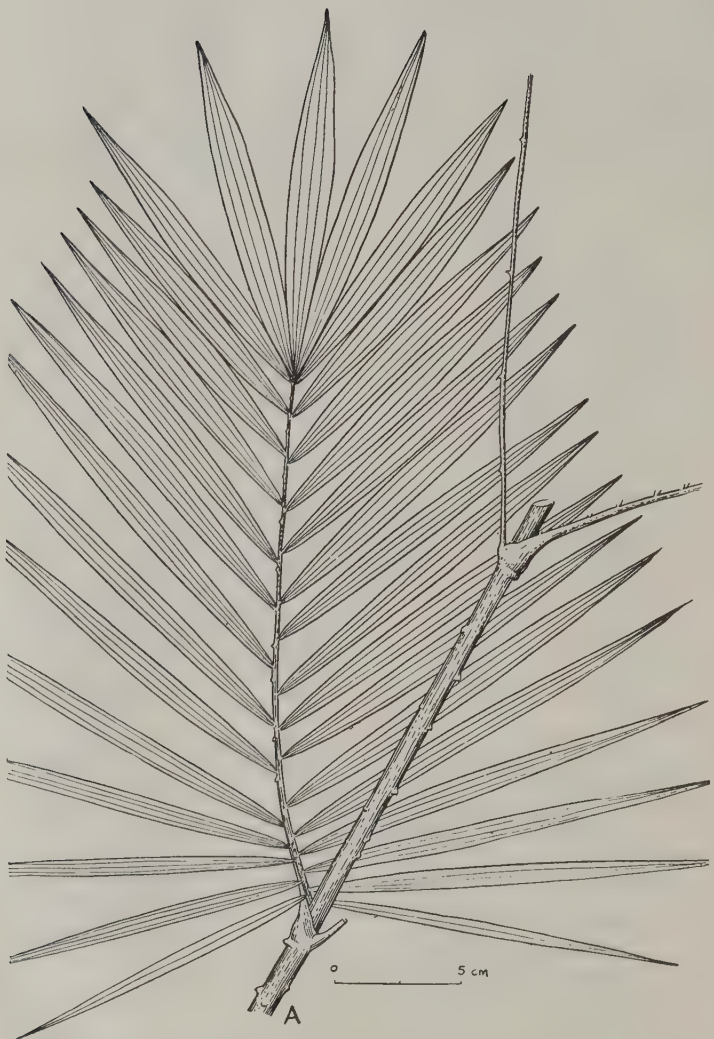
Ab omnibus speciebus hujus subsectionis: vagina frondis striata, aculeis tumescentibus conoideis obtusis vel interdum subito acutis recurvatis solitariis praedita; ocrea obscura; frondibus sessilibus; foliolis inaequidistantibus vel sub-aequidistantibus, anguste lineario-lanceolatis, utrinque inermibus haec species sat distincta.

Caudex scandens gracilis circa 20 m. longus cum vagina 8 mm. in diam., caespitosus. *Vagina* frondis valde striata, brunnescens, flagellifera (flagellum prope vaginae marginem geniculo oppositum, quam frondes duplo vel triplo longius), aculeis 2–3 mm. longis tumescentibus conoideis obtusis vel abrupte pungentibus, recurvatulis, solitariis, remotis praedita, infra petiolum gibbosa, infra gibbum in semi-anello horizontali contracta, apice oblique truncata. *Ocrea* vix visibilis. *Frondes* sessiles, brunnescentes, non-cirriferae, 35–40 cm. longae; rachis deciduo furfuracea, dorso aculeis solitariis parvis uniseriatim praedita, foliolis utrinsecus 14–16. *Foliola* inaequidistantia, 1–3·5 cm. inter se remota, lineario-lanceolata, subtrinervia, subopposita vel partim alternantia, (maxima ad medium sita, 15–20 cm. longa, 8–14 mm. lata), utrinque inermia, apice deciduo penicillata, basi et apice racheos utrinsecus 3–4 nonnihil approximata, duo terminalia basi paulo connata vel libera.

Stem tufted, scandent, about 20 m. long, with sheaths 8 mm. in diam. *Leaf-sheaths* strongly striate, dull, pale coffee-brown, flagelliferous, contracted below the base of the petiole-geniculum into a horizontal semi-annular gibbosity, obliquely truncate at the apex, remotely armed with 2–3 mm. long, swollen, slightly recurved, cone-like warts which are blunt or sharp-pointed at the apex. *Leaves* sessile, non-cirriferous, 35–40 cm. long; rachis deciduously furfuraceous, armed dorsally with short, solitary spines. *Leaflets* inequidistant, about 1–3·5 cm. apart, linear-lanceolate, 3-nerved, subopposite or alternate, unarmed except at the bristly apex; the largest mesial, 15–20 cm. long, 8–14 mm. broad; the basal three pairs very close to each other; the two terminal leaflets free or slightly connate at the base.

MALAYA: Kemaman, prope Ulu Kajang in locis paludosis (Corner 30,595, vern. nom: *Rotan Pandan Wangi*).

The collector notes that this species grows in tufts, each stem growing to a length of about 60 ft. or more and that the crushed tissues smell faintly but distinctly of *Pandan Wangi* (a Pandanus sp.).



Tab. 56. *Calamus pandanosmus (Corner 30,595—holotypus).*
A, Caudicis fragmentum cum folio, et basi flagelli.

The species is sterile; and, if I have ventured to name and describe it as new, it is because of its many characteristic peculiarities. The sheath bears rudimentary spines in the shape of swollen conical knobs which are often blunt and sometimes provided with sharp points. The leaves are sessile and have many inequidistant, unarmed, very narrow, linear-lanceolate leaflets. The flagellum is opposite to the petiole and borne near the lower angle of the obliquely truncate leaf-sheath.

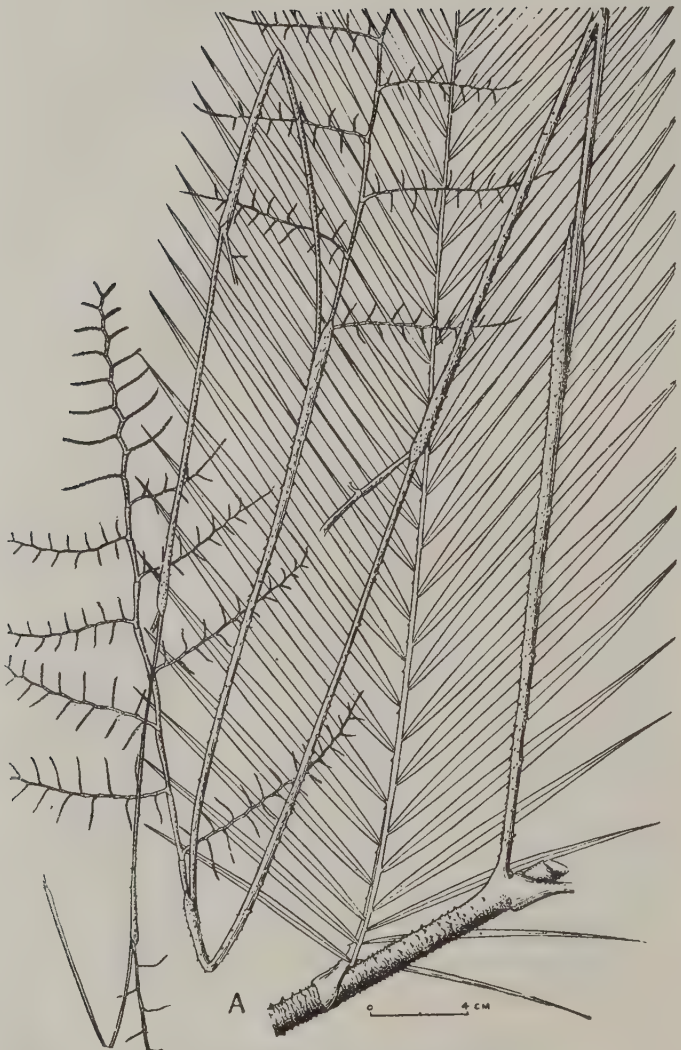
Through a contraction below the gibbosity of the petiole base, a sort of semi-annular swelling is formed, and this perhaps serves as an additional mechanism to fix the claws of the leaf-rachis in the bark of the twigs of the nearest plants. In some internodes the spines may be absent or only a few, and leaf-petioles may not be gibbose even when the plant bears flagella. The leaflets in the earlier leaves are narrower and may be almost equidistant.

57. Calamus Corneri Furtado **sp. nov.—t. 57.**

A C. rugoso, *cui valde affinis, frondibus sessilibus, aculeis vaginarum minoribus ascendentibus, foliolis latioribus.* C. raduloso *in frondibus similis, sed caudicibus multo gracilioribus, frondibus minoribus, spadicibus gracilioribus, vaginae frondalis rugis transversalibus numerosissimis et aculeis minoribus haec species differt.*

Caudex scandens, cum vaginis 1–1·5 cm. in diam., in omnibus partibus coffeatus vel fuscescens. *Vagina* rugis numerosissimis minutis, et aculeis brevissimis 1–2 mm. longis, ascendentibus praedita, apice oblique truncata; flagellum ad latus geniculi prope apice vaginae liberatum. *Ocrea* brevissima, coriacea decidua, rugosa vel partim scabrida, vel non. *Frondes* sessiles, 50–60 cm. longae, secus dorso rachidis unguibus simplicibus armatae. *Foliola* porrecta, aequidistantia, circa 2 cm. inter se dissita, opposita vel alternantia, ensiformia, unicostulata, 15–18 cm. longa, 10–12 mm. lata, in pagina superiore costis marginibusque apicem versus remote setosis, in pagina inferiore inermia, apice penicillata. *Spadix masculus* tantum visus, frondibus multo longior, metralis vel sesquimetralis, in ramos 4–6 spiculiferentes, 15–30 cm. longos divisus, axi minutis aculeolis armatus. *Spathae primariae* tubulares, apice oblique truncatae, aculeis minutis etiam pustuliformibus praedita, maximae ad 25 cm. longae, circa 5 mm. in diam.; spathae secundariae ad 2 cm. longae, tubulares, aculeis minutissimis armatae, apice oblique truncatae; spathae tertiariae conformes, scabridae circa 5 mm. longae. *Spiculae* 1–2 cm. longae, floribus utrinsecus 4–6, alternantibus; spathellae circa 2 mm. longae, infundibuliformes, scabridae. *Involucrum* cupuliforme, scabridum. *Flores masculi* 2–2·5 mm. longi; petala sepalis duplo longiora.

Stem scandent, with sheaths 1–1·5 cm. thick, coloured dark on drying in all parts. *Leaf-sheaths* flagelliferous, transversely and minutely rugose, armed with 1–2 mm. long, ascendent spines. *Leaves* sessile, 50–60 cm. long, armed on the rachis with short, solitary claws. *Leaflets* porrect, equidistant, about 2 cm. apart, ensiform, largest 15–18 cm. long, 10–12 mm. broad. *Male spadix* flagelliform, about a metre



Tab. 57. *Calamus Corneri (Corner 30,058—holotypus).*
A, Caudicis fragmentum cum folio et spadice masculo.

long, divided into 4–6 branches, each 15–30 cm. long. *Spathes* primary tubular, armed with very small spines; secondary minutely aculeolate, about 2 cm. long; tertiary scabrid. *Spikelets* (male) 1–2 cm. long. *Female plant* not known.

MALAYA: Kemaman, Ulu Bendong in Kajang, alt. circa 170 m. (Corner 30,058).

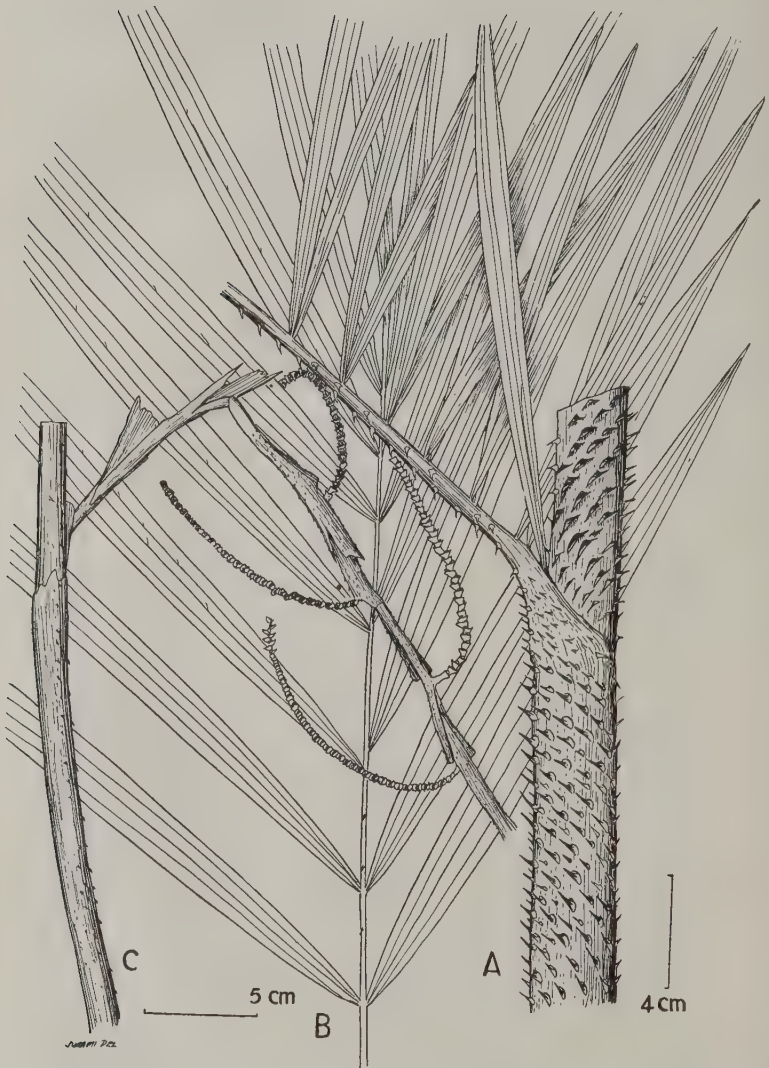
This species is very closely allied to *C. rugosus* from which differs by the sessile leaves, smaller and ascendent spines on leaf-sheaths, and broader leaflets. The only other species of this group which has sessile leaves is *C. radulosus* which is a much larger species having much thicker stems, larger leaves, and thicker spadices; besides its leaf-sheaths are not transversally rugose as those of *C. Corneri.*

The collector's notes read as follows: Male Calamus; stem ½ inch thick (including sheaths). Inflorescence 4½ ft. long. Flagella 3–4 ft. long, slender. Rachis 20–24 inches long. Petiole 0. Sheaths green, with numerous small green spines separated by a faint, incomplete, transverse ridge. Rachis with a single row of small hooked, black-tipped spines and no terminal flagellum. Base of rachis yellowish on each side of mid line dorsally.

58. Calamus radulosus Becc. in Hook, f., Fl. Brit. Ind. VI (1892) 443; Ridl., Mat. Malayan Pen. II (1907) 198; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 174 t. 35; Ridley, Fl. Malay Pen. (1925) 57.—**t. 58.**

Stem scandent, 10–15 m. long, scandent, with sheaths 2·5–3 cm. in diam. *Leaf-sheaths* flagelliferous, gibbous above, obliquely truncate at apex, densely armed with 4–6 mm. long, tumescent-based, triangular, obliquely-inserted, distinctly ascendent spines. *Leaves* sessile, 1–1·5 m. long; rachis armed below with black-tipped, solitary claws which are pluriseriate in the lower portion, uniseriate in the upper. *Leaflets* numerous, equidistant, 2–3 cm. apart, papyraceous, green, glabrous ensiform, acuminate, bristly on the three costae and the margins beneath, often setose only on the mid-costa above; the mesial leaflets the largest, 35–45 cm. long, 25 mm. broad; the terminal two the smallest, shortly connate at the base. *Female spadix* very long, flagelliform, divided into a few 30 cm.–1 m. long branches, each bearing distichously 10–15 spikelets on each side; spikelets deflexed, 8–9 cm. long (largest), with 20–23 distichous flowers on each side. *Primary spathes* cylindric, very long, aculeate, the upper ones often marcescent and decaying in the apical parts; secondary spathes tubular, slightly enlarged and split longitudinally above, obliquely truncate, scarious and lacerated at the mouth, apiculate, strongly scabrid and occasionally aculeate; spathels short, bracteiform, strongly striate, very scabrid-papilose. *Involucrophore* shallow, subcupular; involucre cupular, scarious at margins; female flowers closely packed. *Fruit* when young, globose, with an explanate perianth; scales not channelled, yellowish-brown with a reddish line across the base of the tip. *Male spadix* similar to the female but ultra-decompound.

MALAYA: Perak, loc. incert. (Scortechini 468[b] in Herb. Beccari); Gopeng (Kunstler 8,171).



Tab. 58. *Calamus radulosus (Scortechini 468[b] = ex tab. 35 Beccariana depicta).*

A, Caudicis pars ut armatura vaginae et basis frondis appareant. B, Apex frondis. C, Spadicis pars feminei.

I do not know this species except from Beccari's descriptions and the plate; but the species is well characterised by sessile leaves, short oblique ascendent spines, minutely spinulous margins of the leaflets, and scabrid secondary spathes, and spathels.

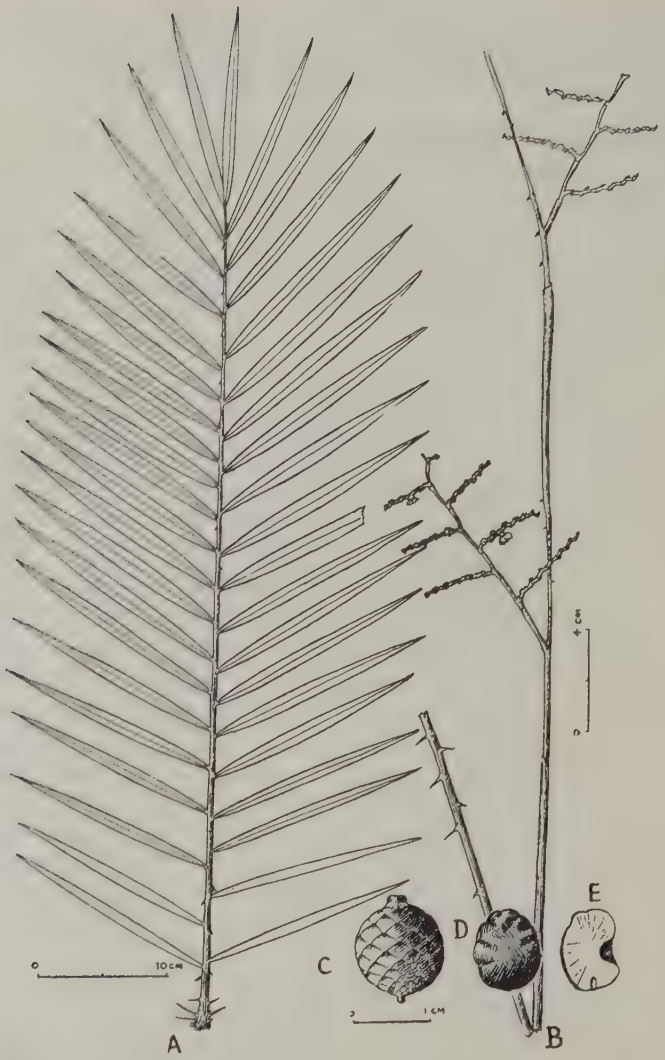
59. Calamus belumutensis Furtado **sp. nov.—t. 59.**

C. brevispadix Ridl. *sensu* Ridl., Fl. Malay Pen. V (1925) 61 quoad specimen infra citatum.

C. rugoso *affinis ut videtur, sed differt frondibus brevissime petiolatis basi secus margines spinis ad 2·5 cm. usque longis praeditis, foliolis fere aequidistantibus paulo latioribus, spadicibus brevioribus, spathis primariis et alteris minus armatis, perianthiis fructiferis magis pedicelliformibus, corollis calycibus aequialtis.*

Caudex scandens, gracilis, mediocriter longus, cum vaginis 1·5–2 cm. in diam. ut videtur, omnibus partibus siccis nigrescentibus. *Vagina* frondis superne gibbosa, apice spinis 5–6 mm. longis horizontalibus vel ascendentibus armatae, parte inferiore ignota. *Frons* unica visa, non-cirrifera, cum petiolo 3 cm. longo 75 cm. longa, foliolis utrinsecus 21–22; petiolus secus margines spinis ad 2 cm. usque longis, reflexis vel porrectis, basalibus longioribus quam superioribus armatus; rachis subtus unguibus solitariis, remotis, brevibus armata. *Foliola* numerosa fere aequidistantia, 2·5–5 cm. inter se dissita, opposita vel alternantia, utrinque inermia, secus margines setosa, lineario ensiformia, subtrinervia, apice acuminata, maxima mesialia 16–18 cm. longa, 17–20 mm. lata; duo apicalia minima, omnino libera. *Spadix femineus* flagelliformis, breviter pedunculatus, frondibus aequilongus ut videtur, parte apicali in specimine viso carenti, in parte basali 2 ramos spiculiferentes 6–9 cm. longos, porrectos, 16 cm. inter se remotos divisus; spiculis 2–3·5 cm. longis, 9–15 flores alternantes ferentibus, circa 10–12 mm. inter se remotis. *Spathae primariae* duae tantum visae; basalis bicarinata 3–4 mm. lata, secus carinas paulo armata; altera spatha tubulosa vix armata; spathae secundariae tubulares, apice ligulatae, inermes vel scabridulae, striatae, 10–12 mm. longae; spathellae scabridulae vel non, infundibuliformes. *Involucrophorum* pateriforme, ad apicem spathellae oriens, sessile; involucrum conforme; areola semilunaris. *Perianthium fructiferum* basi paulo callosum, truncatum, breviter cylindrico-campanulatum, 1–2 mm. altum, lobis brevissimis; corolla calyce aequilonga. *Fructus* sine rostro perianthioque circa 10 mm. longus, ovato vel elliptico oblongus; squamis per series verticales 15 dispositis, sulcatis, margine scariosis, linea intramarginali brunnea mox pallida; semen pisiforme cum fossa foveali profunda; embryone ad basin sito; albumine aequabili, albo.

Stem scandent, short, slender with sheaths 1·5–2 cm. in diam., all parts becoming dark on drying. *Leaf-sheaths* gibbous above, armed at the apex with long, horizontal or ascendent, 5–6 mm. long spines; lower part not known. *Leaf* only one seen, non-cerriferous, 75 cm. long including 3 cm. long petiole; the latter armed on both margins with spines up to 2 cm. long; rachis armed below with short, solitary, remote reflexed spines. *Leaflets* about 21–22 on each side of the rachis, almost equidistant, setose only along the margins, linear-ensiform; the largest 16–18 cm. long, 17–20 mm. broad, the two apical leaflets smallest, free to the base. *Female spadix* flagelliform, probably as long



Tab. 59. *Calamus belumutensis (Holttum 10,670—holotypus).*

A, Frons. B, Spadix femineus. C, Fructus. D, Semen. C, Idem verticaliter discissum ut albumen aequabile et dispositio embryonis appareant.

as the leaves, in the basal half (which is the only part seen) bearing two 6–9 cm. long branches; spikelets 2–3·5 cm. long, each bearing 9–15 flowers. *Primary spathes*, only two seen; the basal bicarinate, slightly armed, the other tubular, scarcely aculeate; secondary spathes tubular unarmed or scabrid. *Fruiting perianth* shortly pedicelliform. *Fruit* ovate or elliptic oblong, beaked; scales disposed in 15 vertical series, channelled in the middle, with a pale brown intramarginal line; seed with white homogeneous albumen with deep foveal cavity; embryo basal.

MALAYA: Johore, Gunong Belumut, alt. 1,000 m. (Holttum 10,670).

The collector notes that the species is common in the locality. Further collections with sheaths and with notes as to its habit, size, etc., are desirable.

Ridley *l.c.* confused this with *C. brevispadix*, and later determined it in the herbarium as *C. bubuensis.*

60. Calamus Tanakadatei Furtado **spec. nov.—t. 60.**

C. luridus Becc. *sensu* Ridl., Mat. Fl. Malayan Pen. II (1907) 198 et Fl. Malay Pen. V (1925) 56 pro parte.

C. muricatus Becc. *sensu* Furtado in Gard. Bull. Straits Settl. VIII (1935) 255 quoad specimena malajana tantum.

C. muricato *affinissima ut videtur, sed petiolis brevioribus et magis aculeatis, foliolis latioribus pluricostulatis inermibus, racheos aculeis frondalis digitatis sat distincta.*

Caudex scandens, 1·5–2·5 cm. in diam., in sicco omnino nigrescens. *Vagina* flagellifera, superne gibbosa, apice oblique truncata, transversaliter rugosa; rugae variabiles, inter se mixtae, maximae spinulis 4–6 mm. longis, ascendentibus armatae, minimae rugae scabridae vel minute spinulosae. *Ocrea* usque ad 1 cm. longa, mox decidua, inconspicua. *Frondes* non-cirriferae, 75 cm. vel plus longae; petiolis 15–30 cm. longis, basin versus rugosis et valde aculeolatis scabridisque, in altera parte minus armatis; aculeis rachidis digitatis reflexis. *Foliola* remota, 7–9 cm. inter se dissita, porrecta, alternantia, lineario-lanceolata, utrinque valde cuneata, apice acuminata, 4–7 costulata, plicatula, concoloria, papyracea, utrinque et secus margines inermia, maxima 30–35 cm. longa, 2·8–3·5 cm. lata; duo terminalia paulo minora, basi libera vel paulo connata. *Spadices feminei* flagelliformes, frondibus longiores, in 3–4 inflorescentias, partiales 12–15 cm. longas, porrectas, aliquid infra spatharum apicem orientes subdivisi; pedunculus circa 30 cm. longus, *Spathae primariae* apice marcescentes, multo ultra bases ramorum productae; basalis spatha bicarinata, valde rugosa, aculeolata; alterae tubulares, striatae apice oblique truncatae. *Spiculae* per inflorescentiam partialem 12–16, alternantes, 1·5–3 cm. inter se remotae, 4–8 cm. longae, floribus congestis; spathellae scabridae, fere cylindricae, oblique truncatae. *Involucrophorum* exsertum prateriforme vel disciforme; involucrum conforme; areola discoidea vel triangularis. *Spadices masculi* femineis similes, sed inflorescentiis partialibus plus divisis; spiculis minoribus gracilioribusque spathis secundariis tertiaribusque et etiam involucris inermibus, floribus masculis pectinatis differt.

Tab. 60. *Calamus Tanakadatei (Moorhouse sn.—holotypus).*
A, Caudicis pars cum spadice femineo. B, Frondis fragmentum mesiale.

Stem scandent, about 1·5–2·5 cm. in diam. *Leaf-sheaths* flagelliferous, gibbous above, obliquely truncate at apex, transversely rugose, the larger wrinkles bearing 4–6 cm. long, ascendent spines, the smaller ones minutely spinulose or scabrid. *Ocrea* small, inconspicuous. *Leaves* non-cirriferous, 75 cm. or more long, including the 15–30 cm. long petiole; the latter rugose and more or less armed like the sheath in the basal half; rachis armed with digitate claws. *Leaflets* remote, 7–9 cm. apart, porrect, alternate, linear-lanceolate, strongly cuneate on both sides, acuminate, 4–7-costulate, plicatulate, concolorous, papyraceous unarmed on both surfaces and along the margins, the largest 30–35 cm. long and 2·8–3·5 cm. broad. *Female spadix* flagelliform, slightly longer than the leaves, short peduncled, subdivided into 3–4 branches, each branch being 12–15 cm. long and bearing 4–8 cm. long spikelets. *Male spadix* similar but decompound and with smaller spikelets.

MALAYA: Negri Sembilan, prope Bukit Senaling (Moorhouse, holotypus, femineus). **Selangor,** Rawang (Ridley 12,118, masculus).

This species may be easily confused with *C. muricatus*, especially due to the darkish colour of the specimens in the herbarium and to the wrinkles and ascendent spines on the leaf-sheaths, but *C. Tanakadatei* is easily distinguished by its broader pluricostulate leaflets which are moreover unarmed on both surfaces and more apart on the leaf-rachis.

Ridley 12,404, collected with fruits at Puak in Sarawak, Borneo, which may be *C. muricatus*, differs from *C. Tanakadatei* in the leaflets being more coriaceous. As the specimen lacks petiole and leaf-sheaths, no further comparison is possible. Its fruits may be described as follows: *Fruiting perianth* subpedicelliform with corolla as long as the calyx but with narrower lobes. *Fruit* young, globose or ovate-globose, 6–7 mm. long, about 5 mm. broad, abruptly mucronate at the apex, slightly narrowed towards the base; scales arranged in 12–13 vertical series, dirty brown with dark brown intramarginal line. *Seed* not developed.

C. muricatus, which was based on a sterile specimen, requires further study as to its variations; but Teysmann's specimen cited by Beccari under *C. muricatus* in Ann. Roy. Bot. Gard. Calc. XI Appendix (1913) 9 may be *C. Holttumii.*

The species is dedicated to the late Prof. Hidezo Tanakadate who came with the Japanese invading army in Singapore and did much to protect the scientific and historical institutions and libraries from looters, and also to give the European scientists who were in Singapore facilities to carry on with the work of their speciality.

I think the vernacular name *Rotan Perut Ayam* was intended for this species, but the ticket was inadvertently mounted on the sheet bearing the spadix of *Rotan Kerai* (*C. luridus*).

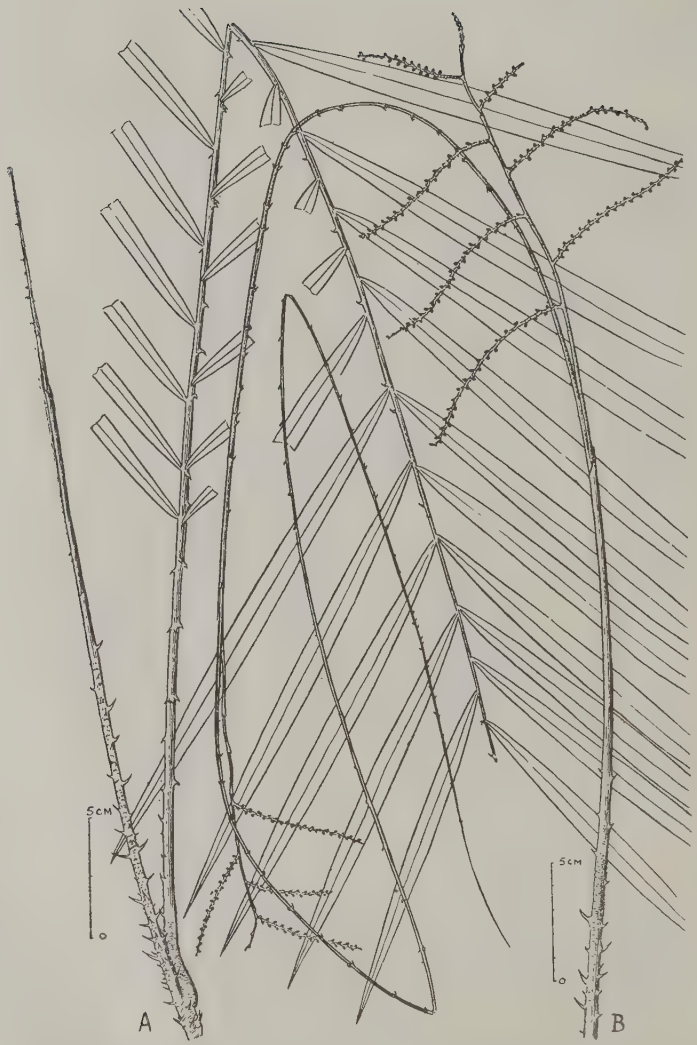
61. Calamus Holttumii Furtado **spec. nov.—t.t. 61 & 61a.**

A C. rugoso, *cui affinissima, haec species foliolis longioribus latioribusque, petiolis et spatha basali basin versus rugosis, spiculis longioribus, spathis secundariis spathellisque vix scabridulis differt. A* C. muricato *foliolis angustioribus et inter se magis approximatis facile distinguitur.*

Caudex scandens, circa 2 cm., in diam., in sicco omnino nigrescens. *Vaginae* flagelliferae, superne gibbosae, rugis minutis apice spinulosis vel non, etiam aculeis ad 10 mm. usque longis ascendentibus basi infra conca-viusculis supra tumescentibus praeditae, deciduo furfuraceae. *Ocrea* coriacea, circa 1 cm. longa, decidua vel non. *Frondes* metrales, non cirriferae; petiolus 17–20 cm. longus, 6–10 mm. latus, bifacialis, squamis brunneis remotis punctatus, basin versus utrinque minute rugosus et aculeis minutis etiam majoribus intermixtis usque ad 5 mm. longis armatus, secus margines et apicem versus dorso aculeis ad 5 mm. usque longis remotis ornatus; rachis dorso unguibus solitariis vel digitatis praedita. *Foliola* equidistantia, opposita vel alternantia, 2·5–4 cm. inter se remota, lineario-ensiformia, apicem versus attenuata, acuminata, 3-costata, in pagina superiore in 2 costis lateralibus spinulosa, in pagina inferiore inermia, secus margines setis minutis inconspicuis praedita; maxima mediana 24–28 cm. longa, 15–23 mm. lata, minima apicalia. *Spadix femineus*, flagelliformis, unguiculatus, cum appendice 1·5 m. longus, in ramos spiculiferentes 2–3 divisus, pedunculo 25–30 cm. longo suffultus. *Spathae primariae*; basalis bicarinata, 10–30 cm. longa, basin versus rugosa et minute spinulosa, secus carinas aculeis usque ad 8 mm. longis praedita, apicem versus oblique truncata, ligulata; alterae spathae cylindricae, apice oblique truncatae, ligulatae, inermes vel unguiculatae, interdum basi rugosae. *Rami primarii* 12–22 cm. longi, utrinsecus 3–6 spiculas gerentes; spathae secundariae elongato-infundibuliformes, inermes, deciduo furfuraceae, oblique truncatae, ligulatae. *Spiculae* simplices, alternantes, 3–4 cm. inter se remotae, 4–8 cm. longae, supra spathae apicem orientes, floribus femineis utrinsecus 12–20 praeditae; spathellae late infundibuliformes, striatae, inermes vel obscure scabridiusculae. *Involucrophorum* fere omnino exsertum, pateriforme; involucrum conforme, triangulare; areola conforme; flores omnes juveniles, sepalis valde striatis. *Perianthium fructiferum* basi callosum, subpedicellatum, in limbo explanatum, calyx quam corolla paulo minor. *Fructus* immaturus, globosus vel elliptico globosus, 7–8 mm. in diam., apice subito rostratus; squamis luteo-brunnescentibus, secus margines atrescentibus, per series verticales 15 dispositis; semen juvenile nondum definibile, cum albumine aequabili ut videtur.

Stem scandent, about 2 cm. in diam., all parts drying dark-brown. *Leaf-sheaths* flagelliferous, gibbous above, provided with spinulous ridged wrinkles and also with ascendent spines up to 10 mm. long, deciduously furfuraceous. *Leaves* non-cirriferous, about a metre long; petiole 17–20 cm. long, 6–10 mm. broad, punctate with brownish scales, rugose on both surfaces towards the base and in the geniculum, armed at the base on the ventral side, on the dorsum towards the apex and along the margins with spines up to 5 mm. long; rachis armed with solitary or digitate claws. *Leaflets* equidistant, 2·5–4 cm. apart, narrow ensiform, 3-costate, unarmed beneath, setose along the two lateral costae above and minutely so along the margins; the largest mesial, 24–28 cm. long, 10–15 mm. wide. *Female spadix* flagelliform, about a metre and a half long, divided into 2–3 spiculiferous branches, each about 12–20 cm. long. *Spathes:* the basal primary about 10–30 cm. long, bicarinate, rugose and densely armed in the basal portion

Tab. 61. *Calamus Holttumii (Holttum 37,395—holotypus).*
A, Caudicis pars cum folio. B, Spadicis fragmentum feminei basale.



Tab. 61a. *Calamus Holttumii (Holttum 17,696—paratypus).*
A. Caudicis pars cum folio et flagello. B. Spadix masculus.

with small or minute spines, and along the carinae with longer, up to 8 mm. spines, unarmed towards the apex; other primary spathes cylindrical, unarmed or clawed, sometimes also rugose and spinulose at the base; secondary spathes unarmed. *Spikelets* 4–8 cm. long, 3–6 on each side, alternate, 3–4 cm. apart, each bearing 12–20 flowers on each side; spathels broadly infundibuliform, unarmed or almost so; flowers very young. *Fruiting perianth* shortly callous at the base, explanate. *Fruit* young, globose or ovate-globose, 7–8 mm. in diam., abruptly beaked; scales straw-coloured, darkish along the margins, arranged in 15 vertical series; seed immature, not yet in the definitive stage.

MALAYA: Johore, Gunong Panti, alt. 500 m. (Holttum 37,395 holotypus, femineus, & 17,696 masculus).

The species is very closely allied to *C. rugosus*, from which it is distinguished by the petioles and the basal primary spathe (sometimes upper ones also) being rugose at the base, the slightly longer and broader leaflets, and the secondary spathes and the spathels being unarmed or nearly so.

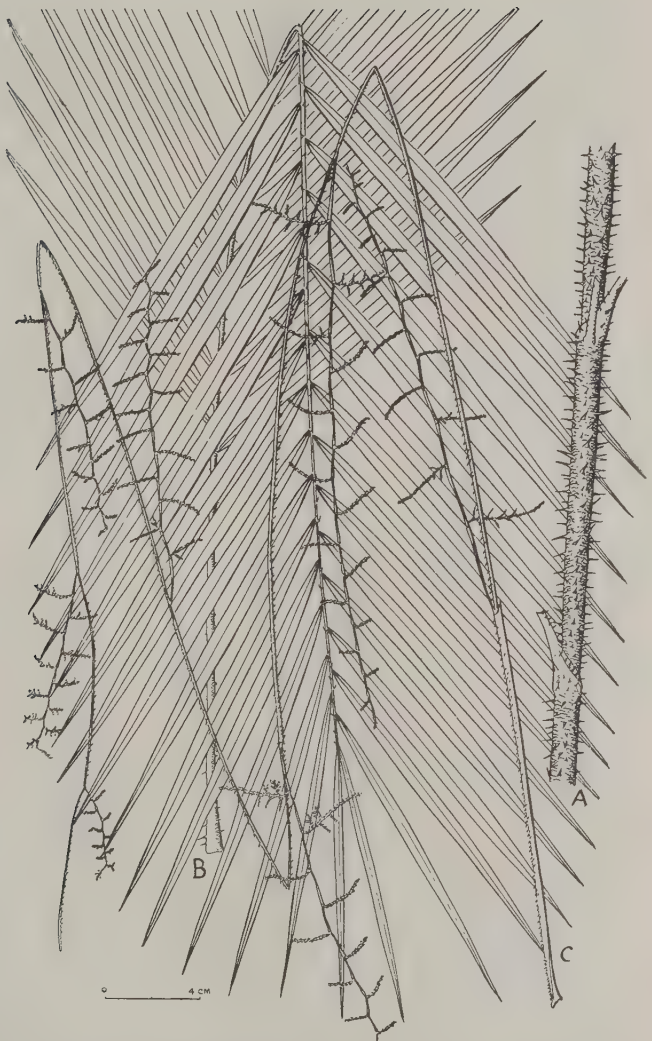
The armature on the leaf-sheath and the spadices is very like that of *C. Tanakadatei* which, however, has much broader leaflets that are placed generally at a greater distance on the leaves than those of *C. Holttumii.*

Perhaps here also belongs Shelford's collection made in Sarawak in March 1901 and distributed as *Tankei Maran.* It is a male specimen having its spikelets borne, as in the female, on the primary branches; but such variations in male spadices occur in many species of Calamus, depending upon the age and other factors. Teysmann identified as *C. muricatus* by Beccari in Ann. Roy. Bot. Gard. Calc. XI Appendix (1913) 9 may be this species; but I have not seen the specimen. *C. muricatus* was described from a sterile specimen having narrow leaflets as in *C. Holttumii*, but very much more distantly disposed on the leaf-rachis; the species requires further study.

62. Calamus rugosus Becc. in Hook. f., Fl. Brit. Ind. VI (1892) 443; Ridl., Mat. Fl. Malayan Pen. II (1907) 198; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 175 t. 36; Ridl., Fl. Malay Pen. V (1925) 58.—**t.t. 62 & 62a.**

Stem scandent, slender, 8–15 mm. in diam., all parts drying black. *Leaf-sheaths* flagelliferous, gibbous above, obliquely truncate, armed with subhorizontal, not deflexed, 4–5 mm. long, triangular spines and with many small, interrupted annular ridges fringed on the crests with very small, confluent spines. *Leaves* 70–80 cm. long including the petiole; the latter 14–20 cm. long, 4–6 mm. broad at base, armed on the margins and on the dorsum, and occasionally on the upper surface towards the base, with short, scattered spines; rachis closely armed beneath with uniseriate, solitary claws. *Leaflets* many, linear-lanceolate, acuminate, bristly on both surfaces and in the margins, or occasionally more or less naked in the lower surface; the largest mesial,

Tab. 62. *Calamus rugosus (Ridley 11,315 ♀).*
Caudicis pars cum folio et spadice femineo.



Tab. 62a. *Calamus rugosus (Ridley 11,314 ♂).*
A, Caudicis pars ut armatura appareat. B, Frons. C, Spadix masculus.

15–25 cm. long, 8–12 mm. broad; the terminal two smallest and free to the base. *Female spadix* very slender, flagelliform, slightly longer than the leaves, divided into 4–5 spiculiferous, 10–15 cm. long, branches. *Spikelets* 6–9 in each branch, 2·5–4 cm. long bearing 4–7 female flowers on each side. *Primary spathes* tubular, closely-sheathing, aculeate; secondary spathes also tubular, 1–2 cm. long, truncate, ligulate, scabrid; spathels scabrid, striate, infundibuliform. *Fruiting perianth* subpedicelliform with the subcallous base; the corolla one and a half times longer than the calyx without the beak about 10 mm. long, 6–8 mm. broad. *Fruit* obovoid-oblong, rostrate, not beaked, scales channelled in the middle, greenish brown, with pale scarious margins and a dark, reddish-brown intramarginal line, disposed in 15–17 vertical series. *Seed* with a homogeneous white albumen and with a basal embryo. *Male spadix* like the female, but with longer partial inflorescences, each often bearing secondary branches with smaller spikelets in the basal half. *Male flowers* 3·5–4 mm. long, 1 mm. broad; calyx half as long as the corolla, abruptly narrowed at the base, not or obscurely striate.

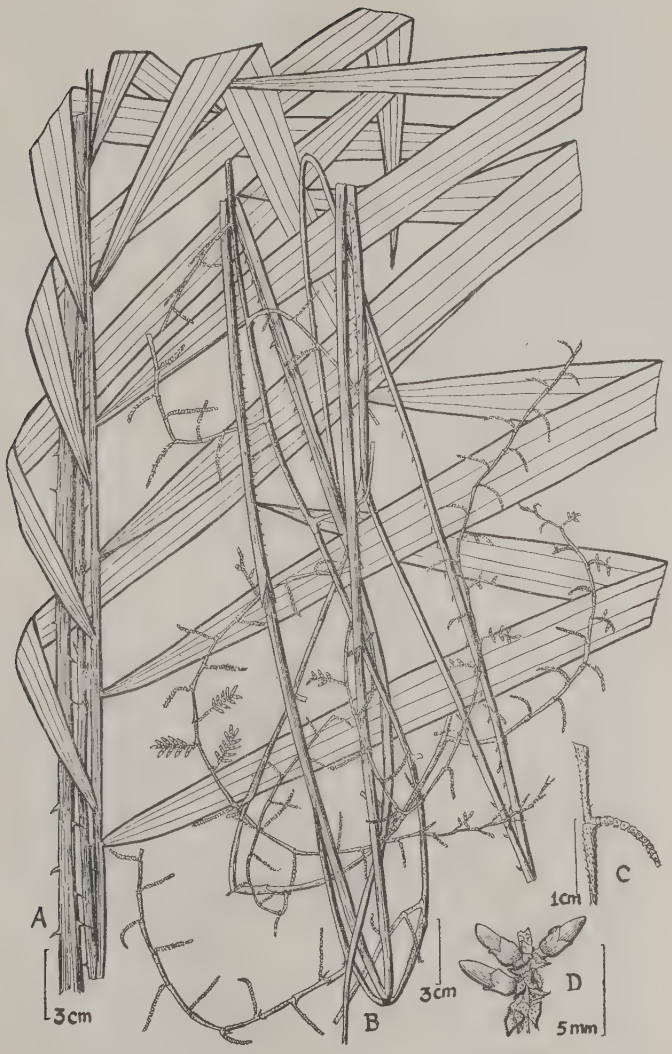
MALAYA: Perak, Maxwell Hill, alt. 1,000 m. (Curtis in V–1890, male); Taiping Hills (Ridley 11,314 male, and 11,315 fruiting, and sn. in II–1904, female).

The species was based on a specimen collected in Perak by Father Scortechini and is apparently endemic on the mountain range near Taiping. I have seen only one detached fruit described here; however it might not be typical.

63. Calamus scabridulus Becc. in Rec. Bot. Surv. Ind. II (1902) 203; in Ann. Roy. Bot. Gard. Calc. XI (1908) 171 t. 32 et in Suppl. (1913) 9 et 34 in nota sub. *C. luridus*; Ridl., Fl. Malay Pen. V (1925) 58 pro parte.—**t. 63.**

C. luridus Becc. *sensu* Ridl., Mat. Fl. Malayan Pen. II (1907) 198 pro parte.

Stem scandent, slender. *Leaf-sheaths* ..... *Leaves* not cirriferous; petiole in the incomplete specimen seen 45 cm. long, 8–10 mm. broad, grooved above, armed along the margins and on the dorsum with simple, occasionally digitate, hooked, up to 5 mm. long spines; lamina a little over a metre long, having 13 leaflets on each side; rachis armed dorsally with one row of simple, sometimes digitate spines. *Leaflets* subequidistant, concolorous, 5–10 cm. apart, lanceolate-ensiform, narrowed at both ends, 3–5 costate, the median three stouter and setose on both surfaces, in the upper surface more than in the lower; transverse veinlets prominent but discontinuous; margins adpressed spinulose; the largest leaflets about 40–50 cm. long, 2·5–3 cm. broad; the terminal pair shortly connate at the base, 22–25 cm. long, about 3 cm. broad. *Male spadix* over 2 m. long, flagelliform with 40–60 cm. long branches, the spikelets borne on the secondary and tertiary, branches. *Primary spathes* tubular, obliquely truncate at the apex, aculeate, sometimes also partly scabrid; secondary spathes narrowly tubular, up to 5 cm. long, scabrid, sometimes finely aculeolate, obliquely truncate, ligulate with ciliated mouth; tertiary spathes 8–15 mm. long, minutely but densely aculeolate or scabrid, obliquely truncate at the mouth. *Spikelets* 1·5 cm. long, with distichous flowers; spathels concave and subbracteiform, densely scabrid; involucre cupuliform,



Tab. 63. *Calamus scabridulus (Fox 11,300).*

A, Folium sine apice basique. B, Spadix masculus. C, Spadicis pars ut spicula, spathae secundariae et earum armatura appareant. D, Spiculae fragmentum.

often partly scabrid. *Female spadix* apparently like the male but the spikelets borne on secondary branches. *Spikelets* up to 6 cm. long; female flowers 2·5 mm. long with corolla twice as long as the calyx.

MALAYA: Johore, Sungai Semang in Muar (Fox sub no. Ridleyano 11,300, male).

SUMATRA: Pulau Billiton (Riedel 1,876, Holotypus).

Of the holotype I have seen only the photographic plate published by Beccari in 1908. In the original description a specimen collected by Motley at Banjarmassing in Borneo and preserved in the Kew Herbarium was doubtfully referred to this species; but from Beccari's note under *C. ruvidus* op. (1908) 170, it appears that the citation, which was meant to appear under the latter species, through an error, appeared under *C. scabridulus*. This error is apparently the sole basis for extending the distribution of *C. scabridulus* also to Borneo, where so far it has not been collected.

64. Calamus luridus Becc. in Hook. f., Fl., Brit. Ind. VI (1892) 445; Ridl., Mat. Fl. Malayan Pen. II (1907) 198 pro parte; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 243 t. 80 et Appendix (1913) 33; Ridl., Fl. Malay Pen. V (1925) 56 pro parte; Furtado in Gard. Bull. Straits Settl., VIII (1935) 253.— **t. 64.**

C. distans Ridl., Fl. Malay Pen. II (1925) 56 **syn. nov.**

Stems scandent, 1·5–2·5 cm. in diam., including the sheaths, about 7–12 m. long, of dark brown colour in the different parts when dry. *Leaf-sheaths* gibbous above, very obliquely truncate at the apex, flagelliferous, closely armed with unequal, up to 1 cm. long, flattened, tumescent-based, schistaceous, reflexed or slightly spreading, solitary or somewhat confluent spines. *Leaves* not cirriferous, about 1 m. or more long including the petiole; the latter 8–20 cm. long, flattish or somewhat channelled above usually prickly on both surfaces and along the margins, but sometimes unarmed above, rachis remotely armed along the margins and in the middle beneath with solitary claws which become confluent or ternate in the terminal part. *Leaflets* remote, equidistant, 4–7 cm. apart, alternate or subopposite, ensiform, distinctly 3-costate, above shining and more or less bristly in the 3-costae, beneath naked and dull; the mesial leaflets largest, 35–40 cm. long, 1·5–3 cm. broad; the two terminal shortly connate at base and slightly broader. *Female spadix* very long, flagelliform, with remote, erectish partial inflorescences, the largest about 30–40 cm. long. *Primary spathes* long, tubular, clawed; secondary spathes 2–3 cm. long, aculeolate or unarmed, tubular, ligulate with a hairy penicillate tip. *Spikelets* 4–7 cm. long, deflexed, with 16–24 alternate, distichous flowers; spathels unarmed or not scabrid. *Fruiting perianth* pedicellate. *Fruit* long beaked, without the perianth and the beak about 11 mm. long, 6–8 mm. in diam., oblong or oblong-obovoid; scales dirty greenish-brown, channelled, with pale scarious margins, disposed in 15–17 series; seed with short superficial ruminations and a homogeneous centre. *Male spadix* much like the female, the larger branches of the spadix bearing in the basal parts spiculiferous branches. *Spikelets* slightly shorter in the male than in the female spadix; involucre cupuliform, sunk. *Flowers* with strongly striate, shortly lobed calyx.

Tab. 64. *Calamus luridus (A–C: Nur 12,188; D–E: Holttum 10,974).*
A, Petiolus cum vagina. B, Folii fragmentum apicale. C, Spadix fructiferens. D, Inflorescentia partialis mascula. E, Spicula mascula.

MALAYA: Trengganu, Gunong Padang (Hislop in VII–1952). **Kelantan,** Gunong Sitong, alt. 300 m. (Nur with Foxworthy 12,188-isoholotype of *C. distans*). **Pahang,** Sungei Yet on Bukit Fraser, alt. 900 m. (Nur 11,130); Fraser Hill, alt. 1,300–1,400 m. (Burkill & Holttum 8,807 vern. nom. *Rotan Tikus*). **Perak,** Kinta Valley (Ridley 9,814); Taiping Hills (Ridley 11,987). **Negri Sembilan,** Bukit Senaling near Kuala Pilah (Moorhouse in 1904 vern. nom. *Rotan Perut Ayam*, in 24–XII–1903, vern. nom. *Rotan Kerai*). **Johore,** Gunong Beridong, alt. 330 m. (Holttum 10,974); ? Sungai Tebrau in Larskine Estate (Ridley 9,207).

The syntypes of this species were all from Perak and the species is not yet known from outside Malaya. Ridley confused the specimens of *C. muricatus* with *C. luridus*, and this misidentification is probably the sole basis for Ridley's including Borneo in the distribution for *C. luridus*. The female flowers in this species have a corolla twice as long as the calyx, a character shared by extremely few species in the genus.

Good specimens of *C. luridus* are needed to study the variation in this species. There is some variation in the specimens cited here, but in the absence of leaf-sheaths and sometimes of other parts it was not possible to determine the significance of this variation or whether more than one species are included here.

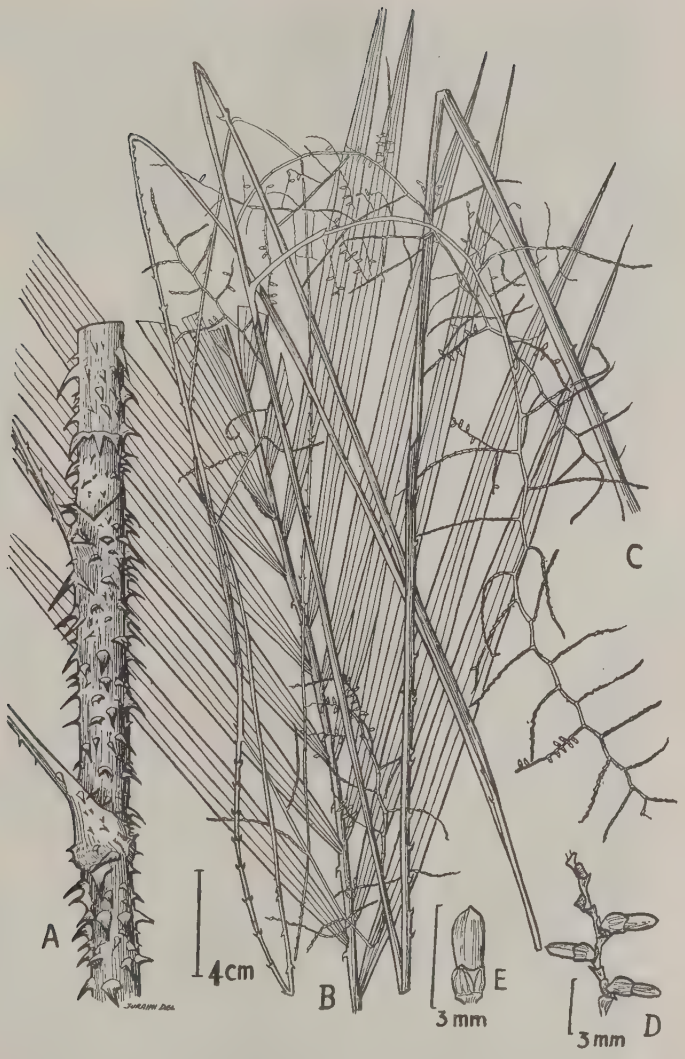
I think both Moorhouse's collection (leaf with a portion of a stem on one sheet, and male spadix on the other) belong to the same collection; the former has a field label written by Moorhouse and is called *Rotan Kerai*; while the latter bears a label copied by Ridley in 1904 and was apparently meant for the specimen named here as *C. Tanakadatei*. Hence the vernacular name *Rotan Perut Ayam* should, in my opinion, belong to the last named species.

Ridley 9,207 from Johore is quoted here with some doubt as it partakes of some characters of *C. scabridulus*.

65. Calamus laxiflorus Becc. in Ann. Roy. Bot. Gard. Calc. XI Appendix (1913) 13 t. 7; Ridl., Fl. Malay Pen. V (1925) 56. —**t. 65.**

C. luridus Becc. *sensu* Ridl., Mat. Fl. Malayan Pen. II (1907) 199 pro parte.

Stem slender, scandent, with sheaths 2–2·5 cm. in diam., all parts drying black. *Leaf-sheaths* flagelliferous, gibbous above, densely armed with solitary or confluent, unequal up to 1·5 cm. long, flat, triangular reflexed spines. *Leaves* petiolate (petiole more than 8 cm. long, not seen in its full length), about 80 cm. or more long; rachis armed beneath with solitary spines in three series, or geminate in the upper parts. *Leaflets* numerous, 3-costulate, ensiform, concolorous, dark, 26–30 cm. long, 15–17 mm. broad, 3–3·5 cm. apart; the three costae more or less bristly on both surfaces, the bristles being fewer or partly absent in the upper surface. *Male spadix* about 2 m. long, flagelliform, divided into 4–5 pendulous branches, the largest 30–35 cm. long; each of the longer primary branches subdivided in the basal parts into 8–10 cm. long secondary branches, each bearing 2·5–3 cm. long filiform



Tab. 65. *Calamus laxiflorus (Ridley 12,607—isoholotypus).*

A, Caudicis fragmentus. B, Frondis pars. C, Spadix masculus. D, Spicula. E, Flos masculus.

spikelets; the apical parts of the long primary branches as well as all short primary branches subdivided into simple, filiform, 4–6 cm. long spikelets. *Primary spathes* long, tubular, aculeate, the striate, longer ones practically unarmed, the others scabridulous; tertiary striate, tubular, scabridulous; male flowers alternate, remote, bifarious, dark. *Female spadix* and fruits unknown.

MALAYA: Singapore, Woodlands (Ridley 12,607, isoholotype).

Among the Malayan species *C. scabridulus* comes very near to *C. laxiflorus*, but the former has very remote, inequidistant broader leaflets, and very scabrid spathes, and spathels. *C. luridus*, which also comes close to this, has inequidistant and broader leaflets, and almost unarmed spathes and spathels.

The holotype is in Beccari's Herbarium in Florence.

66. Calamus balingensis Furtado **sp. nov.—t. 66.**

Caudex solitarius, 8–12 m. longus, cum vaginis circa 2 cm. in diam. *Vagina* frondis flagellifera, infra petiolum gibbosa, aculeis inaequalibus, laminaribus, horizontalibus vel ascendentibus, apice longissime subuliformibus, solitariis, 2–5 cm. longis, apicalibus ad 10 cm. longis porrectis densissime horrida, apice oblique truncata. *Ocrea* brevis, inermis, mox decidua. *Frondes* haud cirriferae, in foliola plurrima aequidistantia ensiformia divisae, 1·60–2 m. longae, in rachide, petioloque dense furfuraceae; petiolus circa 15–25 cm. longus, supra applanatus secus margines aculeolis per series 2–3 dispositis confluentibus ornatus, subtus convexus, basin versus omnino aculeolatus; lamina circa 1·40–1·75 m. longa, in rachidis dorso unguibus per series 3 dispositis, solitariis vel basi confluentibus praedita. *Foliola* aequidistantia, ensiformia, 22–28 cm. longa, 14–16 mm. lata, tricostata, circa 1·5 cm. inter se dissita, duo apicalia minima libera, omnia superne in costis marginibusque setosa, subtus in costis primariis alterisque setulosissima, apice acuminatissima vel acuta, setosa. *Spadix masculus* flagelliformis, frondibus paulo longior, in inflorescentia partiales circa 6, maximas circa 20 cm. longas, divisus; inflorescentiae partiales porrectae, in ramos secundarios spiculiferentes divisae. *Spathae primariae* tubulosae, basali obscure bicarinata magis horrida excepta, cylindricae, valde aculeolatae, aculeis interdum seriatim despositis, apice scariosae vel marcescentes; spathae secundariae elongato infundibuliformes, circa 2 cm. longae, inermes, deciduo furfuraceae; spathae tertiariae minores, conformes deciduo furfuraceae. *Spiculae* marcidae, diruptae tantum visae, circa 2 cm. vel plus longae ut videtur; spathellae infundibuliformes, in ligulam erectam terminatae. *Involucrum* cupuliforme haud exsertum. *Alterae partes* et spadices feminei ignoti.

Stem solitary, 8–12 m. long, with sheaths about 2 cm. in diam. *Leaf-sheaths* flagelliferous, gibbous below the petiole, densely armed with solitary, unequal, 2–5 cm. long, ascendent or horizontal spines; those at the mouth longer and much more slender, up to 10 cm. long. *Leaves* non-cirriferous, densely furfuraceous, 1·60–2 m. long, including the 15–25 cm. long petiole; the latter armed on the dorsal side and along the margins more densely at the base; rachis armed below with solitary or confluent claws arranged in three series. *Leaflets* numerous, closely set, ensiform, largest 22–28 cm. long, 14–16 mm. broad, setose along the nerves on both sides; the two terminal leaflets free, and like the basal ones, among the smallest. *Male spadix* slightly longer than the leaves, clawed in the axis, not provided with a long clawed appendix, divided in about 6 branches, the longest of which being about 20 cm. long. *Spathes:* primary tubular, densely aculeolate, especially the basal one; secondary spathes unarmed, furfuraceous, about 2 cm. long. *Spikelets* apparently about 2 cm. or more long.

Tab. 66. *Calamus balingensis (Furtado 33,073—holotypus).*
A, Frondis fragmentum cum petiolo et parte vaginae. B, Frondis fragmentum apicale. C, Spadix masculus.

MALAYA: Kedah, Gunong Baling, prope Gua Bebu (Furtado 33,073, vern. nom. *Rotan Tanah*).

Only one male spadix was found on the plants, and that too in somewhat decayed state. It is not possible from this to define precisely the specific affinities. But the species is readily recognised by its long, densely arranged spines on the flagelliferous sheaths, by non-cirriferous leaves having ensiform, equidistant leaflets thickly setose in the lower surface, by the presence of thick furfur on the petiole and leaf-rachis, by long, flagelliform spadix which bears closely sheathing armed spathes.

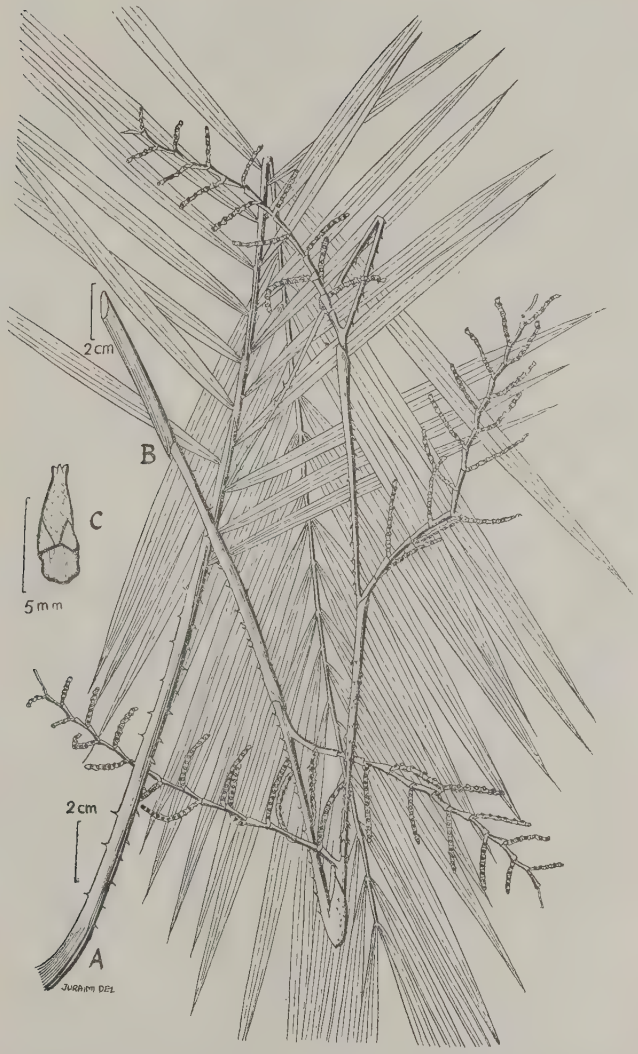
The leaflets in very young plants are arranged in groups, but as the plants grow older, they become equidistant.

67. Calamus pulaiensis Becc. in Ann. Roy. Bot. Gard. Calc. XI Appendix (1913) 34 t. 18; Ridl., Fl. Malay Pen. V (1925) 56. **—t. 67.**

Stem probably scandent and slender. *Leaf-sheaths* gibbous above; petiole 14–20 cm. long, 8–10 mm. broad at its base, provided on the dorsal side towards the base with minute numerous pustular growths and along the margins with 1–4 mm. long, horizontal spines, 8–15 mm. apart; rachis armed underneath with solitary, black-tipped claws. *Leaflets* obscurely 3-costulate, ensiform, acuminate, equidistant, closely-set, 1·5–2 cm. apart, armed with small setae on the 3-costae of the upper surface, and with very minute, somewhat deciduous, hairs on the principal costae, and sometimes on the secondary, on the lower surface; the largest leaflets intermediate, 16–24 cm. long, 10–12 mm. broad; the terminal two smallest and free to the base. *Female spadix* about 1 m. long including the terminal flagellum, divided into 4 branches, each 14–18 cm. long, bearing 12–16 alternate, 2·5–4 cm. long, rigid, spikelets inserted at the mouth of the spathes; each spikelet bearing about 4–9 female flowers on each side. *Primary spathes* very closely sheathing, tubular, aculeate or clawed, 7–15 cm. long; secondary spathes tubular, unarmed, smooth or somewhat striate, covered with the remnants of the deciduous, reddish tomentum, 10–12 cm. long, truncate, shortly ligulate on one side; spathels broadly infundibuliform, somewhat veined, furfuraceous, more or less scabrid, ligulate. *Involucrophore* cupular; female flowers 4–4·5 mm. long; corolla twice as long as the calyx, the latter almost cylindrical, with the base somewhat callous. *Male spadix* not known.

MALAYA: Johore, Gunong Pulai (Ridley 12,199-isoholotype? and s.n. in Dec. 1904, as to the spadix).

This species is easily confused with *C. densiflorus* and in fact the above cited specimens were so named in the Singapore herbarium; but from the latter species *C. pulaiensis* is easily distinguished by its two apical leaflets being free to the base, and a corolla of the female flower being twice as long as the calyx. In this last rare character it resembles *C. luridus*, a species which acquires a dark brown colour in the herbarium specimens. Both *C. luridus* and *C. densiflorus* have broader and more distant leaflets without minute hairs on the costae underneath. Some species



Tab. 67. *Calamus pulaiensis (Ridley 12,199—isoholotypus?).*
A, Folium. B, Spadix femineus. C, Fructus juvenilis.

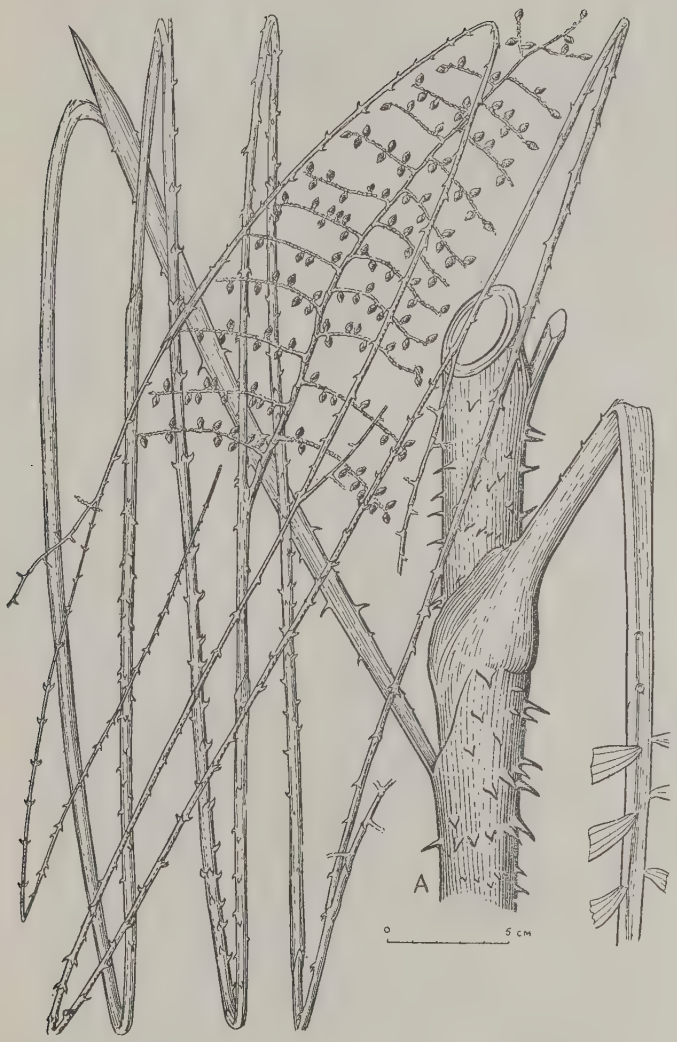
of *C. densiflorus* resembles so very much this species in the spadix and a shape of the leaflets that *C. pulaiensis* might well be suspected to be a hybrid between *C. densiflorus* and a species like *C. exilis*, or some allied species having hairy leaves in the under surface.

Ridley 12,199 in herb. Singapore and the holotype at Kew bear the identical number, but the Kew specimen is dated January 1904 and the Singapore duplicate dated December 1904; I think both the specimens belong to the same collection made in December 1904, but that Ridley entered the word "January", for December through mistake, possibly because the specimen was distributed in January 1905. The unnumbered specimen is also collected on Gunong Pulai in December 1904, but here the spadix of *C. pulaiensis* is mounted with a leaf which does not belong to it.

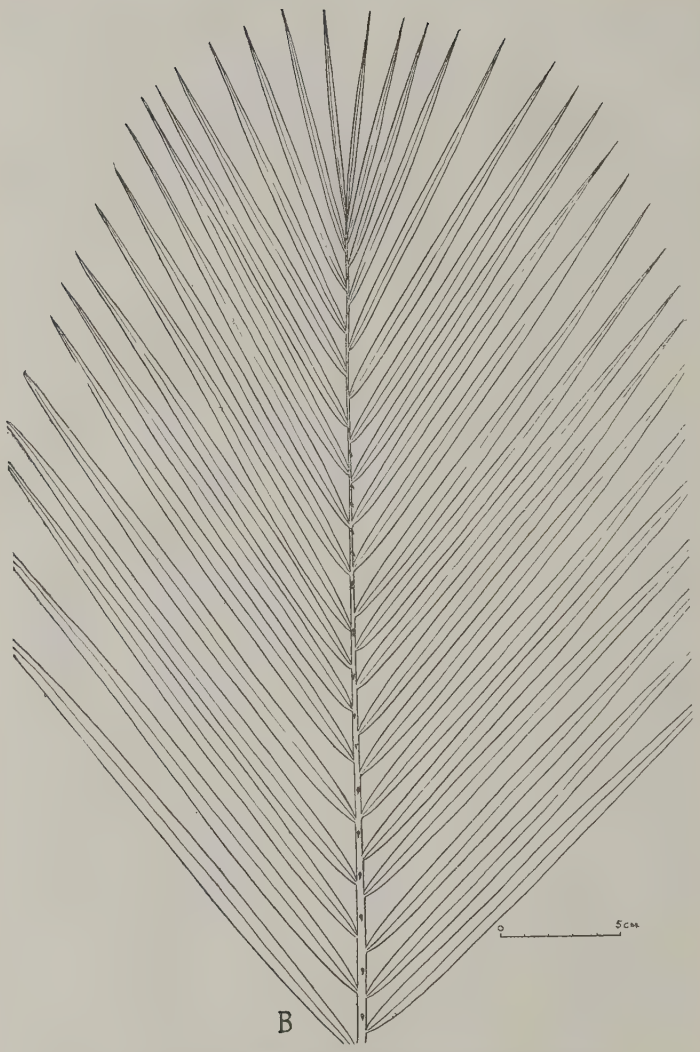
68. Calamus chibehensis, Furtado **sp. nov.—t.t. 68 & 68a.**

C. Burkilliano *similis, sed frondium vaginis deciduo furfuraceis, petiolis secus marginis minus armatis, foliis et spadicibus longioribus, perianthiis fructiferis subpedicellatis, fructibus apparenter majoribus haec species sat dissimilis.*

Caudex scandens, cum vaginis 2·5–3·5 cm. in diam. *Vagina* frondis flagellifera, striata, deciduo furfuracea, aculeis ad 1·5 cm. usque longis, reflexis, triangularibus, dispersis solitariis vel raro basi confluentibus, apicem versus nigricantibus ornata, apice oblique truncata, infra petiolum gibbosa, in gibbo haud armata. *Ocrea* brevis, marcescens, setis densis atrescentibus praedita, secus margines vaginae persistens. *Frondes* cum petiolo circa sesquimetrales, in foliolia equidistantia divisae; petiolus 20–30 cm. longus, supra concaviusculus, infra medium secus margines aculeolatus, supra medium inermis, subtus convexus, apicem versus in dorso unguibus simplicibus remotis ornatus; rachis laminae secus dorsum unguibus solitariis in una serie, in parte apicali versus minoribus praedita, circa 1–1·30 m. longa. *Foliola* plura, alternata vel subopposita, 3 costata, circa 3–5 cm. inter se remota, aequidistantia, porrecta, ensiformia, apicem versus sensim attenuata, maxima 40–50 cm. longa, 2–2·5 cm. lata, apicem frondis versus minora; duo apicalia inter minima, libera vel basi paulo connata; omnia supra secus tres costas et margines remote setosa, subtus inermia. *Spadix femineus* flagelliformis, frondibus longior, in inflorescentias partiales 2–3 divisus, in parte pedunculare 1·5–2 m. longus; inflorescentiae partiales 15–20 cm. longae in spicas 18–22 alternatas divisae. *Spathae primariae* tubulares, basilari bicarinata excepta, cylindricae, aculeatae, apice oblique truncatae, spadicis internodiis minores; spathae secundariae infundibuliformes, inermes, circa 10 mm. longae, furfuro deciduo ferrugineo tectae, striatae, apice fimbriatae, ligulatae. *Spiculae* circa ad 5 cm. longae, ad apicem spathae vel nonnihil supra orientes, horizontales vel reflexae, in axilla callosae, floribus utrinsecus 8–12; spathellae infundibuliformes, 2 mm. longae, apice scariosae. *Involucrophorum* ad spathellae apicem oriens, prateriforme; involucrum conforme; areola lunata. *Perianthium fructiferum* juvenile tantum visum, basi callosum, subpedicelliforme, corolla calyce duplo longior. *Fructus* juvenilis, squamis per series 15 verticales dispositis.



Tab. 68. *Calamus chibehensis (Henderson 29,842—holotypus).*
A, Caudicis pars cum petiolo et spadice femineo.



Tab. 68a. *Calamus chibehensis (Henderson 29,842—holotypus).*
B, Frondis fragmentum apicale.

Stem scandent, apparently over 10 m. long, with sheaths 2·5–3·5 cm. in diam. *Leaf-sheaths* flagelliferous, deciduously furfuraceous, gibbous below the petiole, striate, unarmed in the gibbous part, armed in other parts with about 1·5 cm. long, solitary, scattered, rarely confluent spines and with blackish setae in the ocrea. *Leaves* including the 20–30 cm. long, petiole about 1·5 m. long, armed dorsally in the petiole and rachis with short, solitary spines. *Leaflets* many, ensiform, about 3–5 cm. apart, largest about 40–50 cm. long, 2–2·5 cm. broad. *Female spadix* flagelliform, much longer than the leaves, long peduncled (peduncle about 1·5–2 m. long), divided into about 2–3 branches and terminating in a long clawed appendix; the branches about 15–20 cm. long, each bearing about 18–22 spikelets. *Primary spathes* tubular, aculeolate; secondary spathes tubular, unarmed, 10 mm. long, deciduously ferrugineous. *Spikelets* up to 5 cm. long. *Fruit* very young, with subpedicelliform perianth and with scales arranged in 15 series.

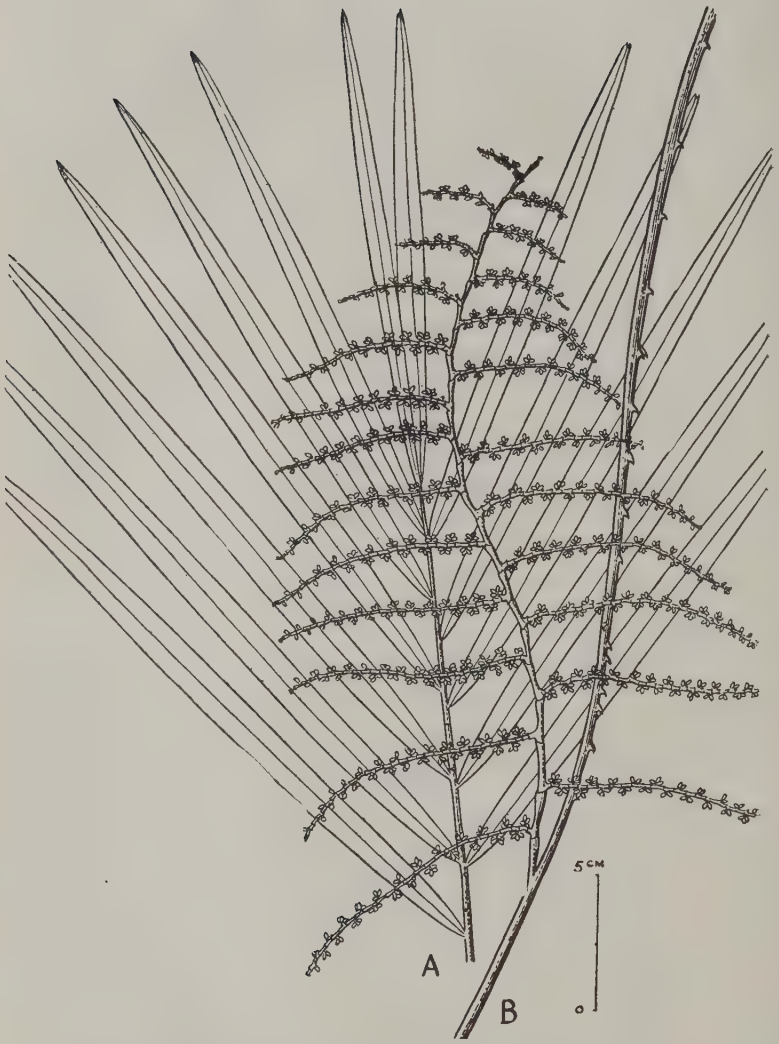
MALAYA: Pahang, Pulau (insula) Chibeh, prope Pulau Tioman (Henderson 29,842).

This species belongs to Beccari's Group V. B. 1., being allied to the subgroup to which *C. Reinwardtii* belongs. It is easily distinguished from its allies by long leaves with long, equidistant leaflets, the long peduncled flagelliform spadices, large stems and thickly setose ocrea which borders the mouth of leaf-sheaths. From *C. Burkillianus*, it is distinguished by the larger dimension of almost all its organs, the presence of deciduous rusty furfur on the sheaths which by persisting for a long time on the bases of the thorns make the latter appear reddish-brown. The fruit too may be larger (in the material it was too immature).

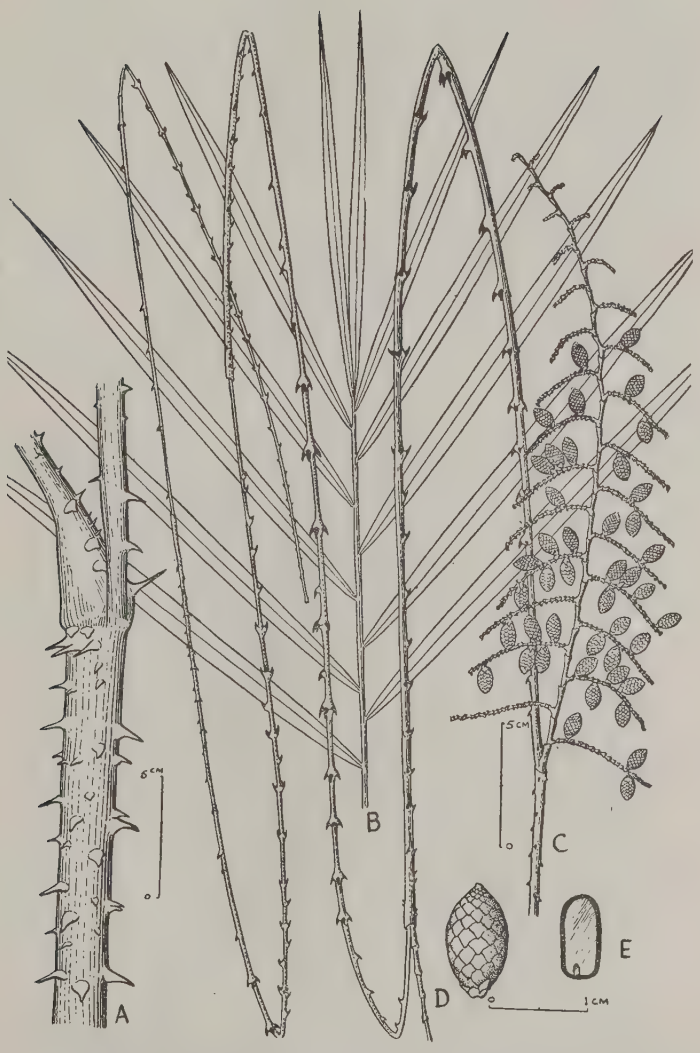
69. Calamus Burkillianus Becc. *ex* Ridl., Fl. Malay Pen. V (1925) 56; Furtado in Gard. Bull. Straits Settl. VII (1935) 245.— **t.t. 69 & 69a.**

Stem scandent, 2–3·5 cm. in diam., apparently about 15 m. or more long. *Leaf-sheaths* light straw-coloured, gibbous below the petiole, armed with similarly coloured, black-tipped, scattered, solitary, horizontal or slightly recurved, 8–15 mm. long spines. *Ocrea* short, hispid. *Leaves* apparently a metre or so long, all parts drying light greenish or straw-coloured, petiole apparently about 30–45 cm. long, slightly covered with a brownish-coloured, deciduous furfur, semi-terete, armed with short spines along the margins; rachis armed with solitary, short claws on the dorsum. *Leaflets* narrow ensiform, equidistant, alternate or opposite, 2–3·5 cm. apart, largest 25–35 cm. long, 1·5–1·8 cm. broad, setose in the two costae above, and in the midcosta below, the terminal shortest, shortly connate at base. *Spadices* much longer than the leaves, ending in a long flagelliform appendix. *Primary spathes* tubular, aculeolate, light green; secondary spathes unarmed, about 1–2 cm. long. *Spadix branches* 20–25 cm. in male, up to 50 cm. in female spadices. *Spikelets* in the female spadices up to 12 cm. long, shorter in the male; male flowers usually on a short tertiary branches so as to appear as if in groups. *Fruiting perianth* explanate or shortly pedicelliform, corolla nearly twice as long as the calyx. *Fruit* ellipsoid, narrowed on both sides, about 12 mm. long, 5 mm. in diam.; scales arranged in 15–16 longitudinal series, light coloured, with dark intramarginal lines; seed oblong, not ruminate.

MALAYA: Pahang, Pulau Tioman, Joara Bay (Burkill s.n. VI–1915–Isoholotype); Ayer Batang (Henderson 18,465). **Trengganu,** Pulau Kapas (Holttum 15,211).



Tab. 69. *Calamus Burkillianus (Henderson 18,465 ♂).*
A, Frondis fragmentum apicale. B, Pars spadicis masculi.



Tab. 69a. Calamus Burkillianus *(Burkill sn.—Isoholotypus).*

A, Frondis vagina. B, Frondis fragmentum apicale. C, Pars spadicis fructiferentis. C, Fructus. E, Semen ejusdem verticaliter discissum.

As the species was inadequately described by Ridley, a fuller description was given by me in Gard. Bull. l.c. The tertiary branches in the male spadix is about 1 cm. long, bearing about 8 flowers. The male corolla which is about 4 mm. long is nearly twice as long as the calyx. The fruiting perianth is explanate with a short callous base, and the corolla nearly double the length of the calyx.

70. Calamus densiflorus Becc. in Hook. f., Fl. Brit. Ind. VI (1892) 445 & Rec. Bot. Surv. Ind. II (1902) 205; Ridl., Mat. Fl. Malay Pen. II (1907) 196; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 376 pl. 157. Suppl. (1913) 75; Ridl., Fl. Malay Pen. V (1925) 53.—**t.t. 70 & 70a.**

C. neglectus Becc. in Hook. f., op. cit. VI (1893) 458 et in Ann. cit. XI (1908) 416 pl. 182, Suppl. (1913) 100 pl. 56, Ridl., Fl. Malay Pen. V (1925) 62. **syn. nov.**

Stem scandent, 5 m. or more long, 3–4 cm. in diam. with sheaths. *Leaf-sheaths* obliquely truncate at the apex, with a short marcescent ocrea, gibbous below the petiole, straw-coloured when dry, armed with flattened triangular, unequal, up to 1·5 cm. long, straw-coloured reflexed spines. *Leaves* not cirriferous, rarely subcirriferous, the terminal leaflets considerably reduced, sometimes imparipinnate, 2–2·5 m. long; rachis armed with solitary or irregularly confluent, swollen-based, black-tipped claws; petiole obscure or absent, in one specimen 10 cm. long, armed along the margins and above with small, scattered prickles. *Leaflets* numerous, equidistant, opposite or almost so, 1·5–2·5 cm. apart, linear-ensiform, the terminal pair shortest, the basal ones very narrow, though nearly as long as the middle ones, the latter largest about 30–35 cm. long, 1·5 cm. broad, all 3-costate; costae in the upper surface spinulous above towards the terminal portions only, in the lower surface strongly spinulous even on the middle; margins adpressedly spinulous. *Female spadix* elongate, flagelliform, divided into secondary branches; partial inflorescences remote, few, 25–35 cm. long, longer in vigorous specimens, bearing 7–13 spikelets and terminating in a short sterile appendix. *Primary spathes* tubular, elongated, armed with short, scattered or confluent, recurved spines; secondary spathes unarmed, 2–4 cm. long, deciduously rusty-furfuraceous, striate. *Spikelets* 4–8 cm. long, somewhat reflexed, bearing 10–16 flowers on each side; spathels closely packed, rusty-furfuraceous, striate, bracteate. *Involucrophore* cupular, almost exsert; involucre cupular with entire or undulate margins, included in the involucrophore cup. *Female flowers* bifarious, 5 mm. long, calyx, striate, furfuraceous. *Fruiting perianth* shortly pedicelliform; corolla as long as the calyx, the latter ¾ split. *Fruits* closely packed, obovate, suddenly and stoutly rostrate, 15–17 mm. long, including the beak, 1 cm. in diam.; scales in 18 series, slightly channelled, straw-coloured with rather reddish-brown margins; seed ovoid-elliptic, deeply pitted, ruminate, 1 cm. long, 7 mm. broad, 5 mm. thick; embryo in the centre, opposite the chalazal fovea. *Male spadix* often divided into tertiary, flower-bearing branches; secondary spathes sometimes sparingly armed, 1·5–2 cm. long; tertiary spathes 0·5 cm. long, rusty-furfuraceous, infundibuliform. *Spikelets* when borne on the primary branches 3–4 cm. long, when borne on the secondary branches, 1·5–2 cm. long, 6–10 mm. apart; spathels bracteiform, with broad triangular ciliate point, furfuraceous; flowers bifarous, pectinately packed, deciduously rusty-furfuraceous; calyx distinctly striate.

Tab. 70. *Calamus densiflorus (Ridley 10,861 ♂).*
A. Frondis pars. B, Spadicis pars masculi.

Tab. 70a. *Calamus densiflorus (Holttum 9,415 ♀).*

A, Petiolus cum vagina. B, Frondis pars. C, Spadix fructiferens. D. Fructus. E, Semen. F, Idem verticaliter discissum.

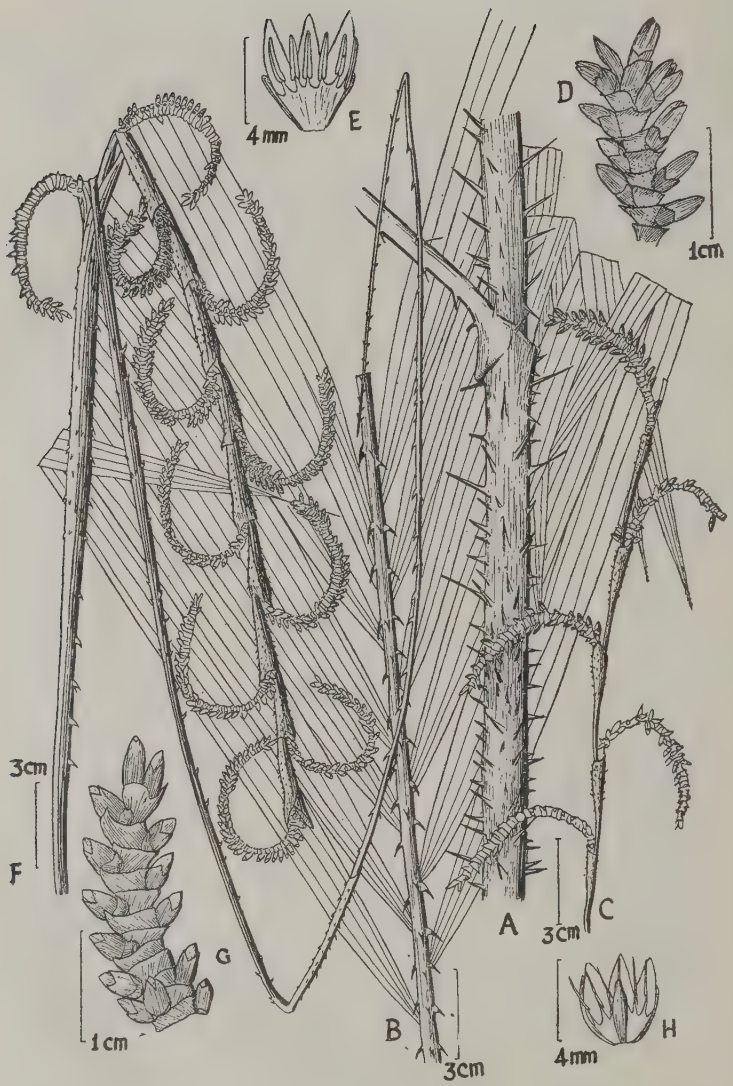
MALAYA: Kemaman, loc. incert. (Vaughan-Stevens); Bukit Kajang (Corner 30,514 male and female). **Perak,** Bujong Malacca (Curtis 3,353). **Selangor,** Batang Berjuntai (Ridley 7,881); **Kuala Lumpur,** (Ridley 3,495). **Johore,** Kluang (Holttum 9,415). **Singapore,** Bukit Mandai (Ridley 6,280, vern. nom. *Rotan Chichi*); Gardens' Jungle (Ridley 9,850 & 10,861, both male).

In this species the terminal leaflets are diminutive, and are either paripinnate (free, or more or less united), or imparipinnate, or the leaf ends in a small cirrus. *C. densiflorus* was described on specimens (Kunstler 5,527 and 8,434 from Taiping, Perak) having no terminal portions, and bearing rather stout spikelets with congested flowers. *C. neglectus* on the other hand, was based on a specimen (Griffith 6,399 bis from Malacca), which had a small cirrus, and so the two species were placed by Beccari in two different sections. I have not been able to see the syntypes of *C. densiflorus*, nor the holotype of *C. neglectus*. My conclusions that both these two binomials represent only one species have been derived after comparing the plates of the types, the descriptions and the specimens subsequently identified by Beccari. The only difference one may notice is that the spathels in *C. neglectus* are slightly more apart than in the typical *C. densiflorus*, and that the lowermost secondary spathes are slightly armed, but such variations are seen in this species.

In 1907 Ridley (op. cit. p. 197) had quoted the Kuala Lumpur specimen (Ridley 3,495) under *C. densiflorus*, but subsequently, when the specimen was identified by Beccari (1913) as *C. neglectus*, Ridley (1925) quoted the specimen under both the species. *C. densiflorus* has great affinities with *C. Ridleyanus* and, were it not for the conspicuous armature of the primary spathes and peculiar indumentum and prickles on the secondary spathes, many of the flowering specimens of *C. Ridleyanus* would have been separated with difficulty from *C. densiflorus*.

71. Calamus Ridleyanus Becc. in Rec. Bot. Surv. Ind. 11 (1902) 205; Ridl., Mat. Fl. Malayan Pen. II (1907) 197; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 378 pl. 158, Appendix 1913) 77; Ridl., Fl. Malay Pen. V (11925) 54.—**t. 71.**

Stem tufted, scandent, about 15 m. long, 2–2·5 cm. in diam. with sheaths. *Leaf-sheaths* gibbous beneath the petiole, armed with unequal, flat, narrowly triangular, nigrescent, spreading or somewhat ascendent, solitary or approximate spines, the largest of which are 15–20 mm. long, but those at the mouth fewer, narrower and up to 4 cm. long. *Leaves* large, 1–1·5 m. long, subcirriferous; rachis armed beneath with simple or ternate, black-tipped claws; petiole 12–15 cm. long, deeply channelled above, armed beneath along the margins with two or more rows of small spines and with one row along the dorsum. *Leaflets* numerous equidistant or nearly so, alternate to opposite, 4–5 cm. apart, the mesial the largest, 40–45 cm. long, 2–2·5 cm. broad (shorter and narrower in a male specimen seen), the basal the narrowest, the



Tab. 71. *Calamus Ridleyanus (A–E: Corner 30,536 ♂; F–H: Ridley 11,460 ♀).*

A, Caudicis pars. B, Frondis fragmentum. C, Spadicis fragmentum masculi. D, Spicula mascula. E, Flos masculus apertus. F, Fragmentum spadicis feminei. G, Spicula feminea. H, Flos femineus apertus ut ovarium et staminodii dispositio appareant.

terminal the shortest, diminutive, green on both sides, smooth above and along the margins, but bristly at the apex and on the median nerve and often along the two side nerves beneath. *Female spadix* flagelliform, nearly 2 m. long, with spikelet-bearing, pendulous, primary branches about 45–60 cm. long. *Primary spathes* tubular rather densely armed; secondary spathes with small tuberculiform-based, recurved prickles and with a broad, erect exsuccous ligule, 2·5–4 cm. long. *Spikelets* vermicular, 5–11 cm. long, recurved, inserted inside the mouth of the axillant spathe; spathels broadly infundibuliform, rusty-furfuraceous, obscurely striate, 2 mm. long. *Involucrophore* deeply cupular, almost enclosed in its spathel; involucre nearly as long, cupular with entire margins. *Female flowers* ovoid, 4 mm. long. *Male spadix* almost similar to the female, but spikelets are borne rarely on primary branches 5–8 cm. long, and usually on secondary branches 1–2 cm. long.

MALAYA: Kemaman, Sungai Nipa (Corner 30,536, male). **Johore,** Gunong Pulai (Ridley 12,202 and in Dec. 1904). **Singapore,** Mandai (Ridley 3,504, syntype); Gardens Jungle (Ridley 6,901, syntype, and 11,460).

The species was hitherto known from female specimens only; Corner 30,536, which is male, is specifically identical, despite the fact that it presents certain small differences from the female specimens. As the fruit is as yet unknown, it is yet difficult to determine the exact affinities of the species, though it appears to be very near *C. densiflorus* with which some specimens have been confused in the herbarium.

72. Calamus Diepenhorstii Miq., Prodr. Fl. Sum. (1860) 594 et in Journ. Bot. Neerl. I (1861) 21; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 454; Ridl., Mat. Fl. Malayan Pen. II (1907) 199; Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 322 t. 126; Ridl., Fl. Malay Pen. V (1925) 55 pro parte = (**var. Diepenhorstii**).

C. insignis Griff. *sensu* Ridl., op. cit. (1907) 193 et V (1926) 51 quoad descriptionem spadicis fructiferi.

? *C. pacificus* Ridl., in Journ. F.M.S. Mus. VI (1915) 59.

C. singaporensis Becc. *sensu* Ridl., op. cit. (1907) 199 partim.

Stem tufted, scandent, 15–20 cm. long, with sheaths about 2–3·5 cm. in diam. *Leaf-sheaths* flagelliferous, slightly gibbous under the petiole, more or less densely armed with flat, triangular, 1–2 cm. long spines having furfuraceous margins, tumescent bases, and sharply demarcated black lamina. *Leaves* non-cirriferous, 70 cm. to 2 m. long; petiole 20–30 cm. long, sometimes longer, armed in the lower surface along the margins and the middle with short, black tipped claws; rachis armed beneath with claws in three series in the lower half and in one series in the upper one. *Leaflets* numerous, ensiform, equidistant, 2–3 cm. apart, opposite or alternate, armed with black setae on the median nerve of the upper surface, and on the two side nerves and often also the median nerve of the lower surface, and terminating in a long bristly tip; mesial leaflets largest, 35–45 cm. long, 15–18 mm. broad; the two terminal leaflets free. *Female spadix* flagelliform,

slender, strongly clawed, very long peduncled (peduncle sometimes as long as 3 m. long), divided into 4–6 pendulous, about 15–30 cm. long partial inflorescences. *Primary spathes* tubular, aculeate, obliquely truncate, ligulate; secondary spathes unarmed or occasionally obscurely armed, truncate and ligulate at apex, larger ones 5–6 cm. long. *Spikelets* simple, occasionally branched at the base, 7–12 cm. long, about 8–10 in each of the larger partial inflorescences, with about 18–22 alternate flowers; spathellae tubular, infundibuliform, truncate and slightly ligulate, deciduously furfuraceous, 3–5 mm. long. *Fruiting perianth* subpedicelliform, usually split almost to the base. *Fruit* globose, 18–20 mm. in diam., shortly mucronate; scales in 18–21, rarely up 24, longitudinal series, light yellowish with a narrow, dark intramarginal line which tends to become lighter with age, and with a very narrow hyaline margin; seed globular with deeply ruminate albumen. *Male spadix* very like the female but with shorter secondary spathes, spikelets and spathels, and with smaller pectinate flowers.

MALAYA: Penang, Muka Head (Curtis 765). **Perak,** Taiping Hills (Ridley 11,412 and 11,411); Kuala Kangsar (Haniff 14,942); Temango (Ridley 14,714); Pangkor (Ridley 7,898, vern. nom. *Rotan Chichi*); Kinta Valley (Ridley 9,815); Lumut (Ridley 10,341; Burkill 512; Ridley 9,472 partly). **Pahang,** Tahan River (Ridley in 1891); Raub on the Bentong Boundary, alt. 600 m. (Furtado 33,103); Mentakab (Holttum 24,565). **Negri Sembilan,** Seremban (Furtado 33,132); Kuala Pilah (Moorhouse in vern. nom. *Rotan Koman*); Gunong Angsi (Holttum 9,912). **Malacca,** loc. incert. (Alvins 1,999, vern. nom. *Rotan Layo*). **Selangor,** Bukit Enggang Kajang (Symington 24,198); Seminyik (Hume 8,281).

SUMATRA: Siberut Island (Boden-Kloss 11,446).

The holotype of this species was collected by Diepenhorst in the Province of Priaman in Sumatra.

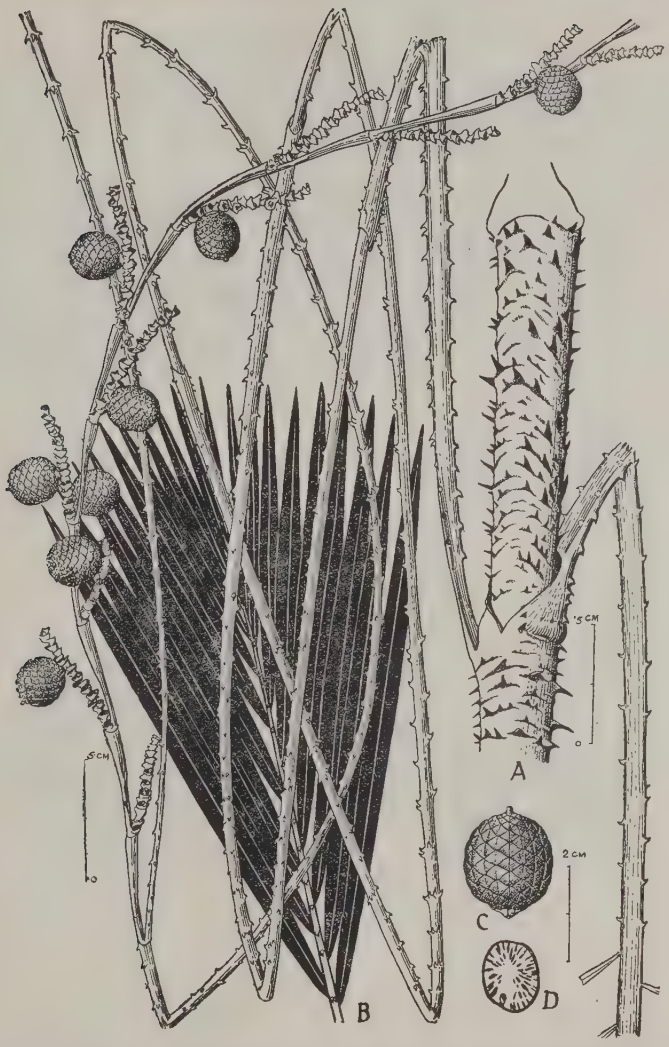
The species appears to vary a great deal as to the dimensions and the degree of branching of the spadices, the size of the fruit and the number of its scales. In Malayan specimens the fruit scales are aranged in 18–21 series, but a specimen collected by Beccari (op. cit. 1908 p. 325) showed 24 series.

Ridley united the var. *singaporensis* with this and also mistook a fruiting spadix of this species (in Ridley 9,472) for that of *C. insignis*.

I have not been able to locate the types in Singapore and Kew of *C. pacificus* Ridl. from Gunong Kerbau, Perak. From the description it is difficult to identify; but the nearest that I could get to in my keys was *C. Diepenhorstii*. The binominal *C. pacificus* Ridl. has been overlooked by Ridley in Flora (1925).

72. (a) Calamus Diepenhorstii var. **singaporensis** (Becc.) Becc. in Ann. Roy. Bot. Gard. Calc. XI (1908) 325 et Appendix (1913) 51.

C. diffusus Becc. *sensu* Ridl., Mat. Fl. Mal. Pen. II (1907) 209 partim; Furtado in Gard. Bull. VIII (1935) 248 as to leaf in Ridley 11,215.



Tab. 72. *Calamus Diepenhorstii var. kemamanensis (Corner 30,355—holotypus).*

A, Fragmentum caudicis cum petiolo et spadice fructiferenti. B, Folii pars. C, Fructus. D, Semen ejusdem verticaliter discissum.

C. Oxleyanus T. & B. *sensu* Ridl., Fl. Mal. Pen. V (1925) 62 as to leaf in Ridley 11,215.

C. singaporensis Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 454; Ridl., Mat. Fl. Mal. Pen. II (1907) 199 pro parte (ex altera parte = *C. Diepenhorstii* Miq. forma typica).

C. Diepenhorstii Miq. *sensu* Ridl., Fl. Malay Pen. V (1925) 55 pro parte.

This variety differs from the type in the leaflets which has their midcosta and secondary nerves naked on both surfaces or with a few bristles only on the midcosta in the upper surface. The leaflets are also somewhat more apart than in the type.

MALAYA: Singapore, Gardens Jungle (Ridley 11,459 and in IV–1905); Bukit Timah (Ridley in 1907); cultivated in Gardens (Ridley 11,515). **Johore,** Kuala Tebing Tinggi (Ridley 11,206); Mount Austen (Ridley 12,590); Batu Pahat (Ridley 11,215 leaves only). **Pahang,** Pulau Tioman, Tanjong Duatah (Burkill 1,107 vern. nom. *Rotan Layer*); Gunong Rokam, alt. 800 m. (Nur 18,783); Sedagong (Henderson 18,382).

If Ridley 11,200 (the number cited by Beccari in 1908) is a misprint for Ridley 11,206, then the latter number should be considered as the apotype of this variety.

Ridley 11,215 which was referred to *C. diffusus* is a mixture of *C. Diepenhorstii* var. *singaporensis* and *C. Oxleyanus.*

72. (b) Calamus Diepenhorstii Miq. var. **kemamanensis** Furtado **var. nov.—t. 72.**

Differt a forma typica aculeis vaginae frondalis paucioribus nonnihil minoribusque; spiculis femineis arrectis brevioribus, paulo infra spathae apicem secundariae sitis; spathellis brevioribus.

This variety resembles very much the type taxon and cannot be easily distinguished from it without the spadix. The spikelets remain porrect even when bearing fully mature fruits, the axillary callus which causes the spikelets to spread or to be reflexed being absent in this variety. The fruit scales are disposed in 18 vertical series.

MALAYA: Kemaman, Ulu Bedong prope Kajang alt. 150 m. (Corner 30,073); Bukit Kajang, alt. 150 m. (Corner 30,355, Holotypus).

LIST OF COLLECTORS' NUMBERS

The number in brackets refer to the number of the name of the species or variety under which the collector's number is quoted.

ALVINS—253 (47), 287 (1b), 583 (1b), 1,883 (49), 1,971 (46), 1,999 (72), 2,100 (49), 2,253 (11), 2,303 (44c).

ANDERSON—21 (25), 167 (25), 168 (44c).

BECCARI—P.S. No. 833 (50).

BODEN-KLOSS—11,446 (72), 12,140 (28).

BURKILL—512 (72), 592 (16), 750 (45), 990 (3), 1,107 (72a), 1,511 (2), 2,037 (2), 2,163 (1a), 2,536 (9).

BURKILL & HANIFF—12,590 (44a), 12,688 (36), 12,767 (25), 12,771 (4), 12,901 (25), 13,188 (25), 13,219 (44c), 13,239 (36), 13,313 (55), 13,446 (48), 13,451 (48).

BURKILL & HOLTTUM—7,757 (39), 7,814 (44c), 8,420 (31), 8,421 (39), 8,551 (31), 8,683 (27), 8,807 (64).

BURN-MURDOCH—193 (27), cf. Ridley's no.

CLEMENS—40,520 (12a).

CLEMENTE & PUASA—4,942 (16).

CORNER—A (28), 28,539 (39), 29,284 (43), 29,999 (4), 30,058 (57), 30,069 (4), 30,073 (72b), 30,076 (8), 30,096 (39), 30,097 (39), 30,152 (4), 30,173 (50), 30,355 (72b), 30,364 (49), 30,468 (22), 30,508 (39), 30,514 (70), 30,515 (39), 30,516 (39), 30,522 (36), 30,535 (42), 30,536 (71), 30,561 (17), 30,595 (56), 30,875 (38), 31,446 (4), 32,234 (39), 32,768 (41).

CORNER & FURTADO—29,474 (21).

CUADRA—A2,435.

CURTIS—765 (72), 2,268 (45), 2,392 (4), 3,161 (46), 3,248 (35), 3,353 (70), 3,454 (1b), 3,765 (51).

DERRY'S COLLECTOR—80 (44c).

DOLMEN—28,159 (39).

ELMER—20,612 (2).

ENGGOH—7,433 (2).

FOX—cf. Ridley's no.

FURTADO—30,801 (16), 30,804 (33), 30,815 (3), 30,829 (44c), 30,842 (44c), 30,904 (51), 30,906 (12b), 30,922 (16), 30,923 (16), 33,007 (7), 33,010[a] (1b), 33,011[a] (1b), 33,013 (9), 33,023 (44c), 33,030[a] (18), 33,031 (44c), 33,032 (44a), 33,035 (9), 33,035[a] (9), 33,051 (1b), 33,052 (1b), 33,053 (44c), 33,059 (17), 33,061 (9), 33,063 (9), 33,064 (9), 33,067 (17), 33,068 (44c), 33,072 (50), 33,073 (66), 33,083 (36), 33,091 (48), 33,091[a] (48), 33,101 (50), 33,102 (44d), 33,103 (72), 33,107 (23), 33,132 (72).

FMS. COLL.—27,607 (44a), cf. respective Collectors.

GOODENOUGH—1,397 (1b), 1,721 (1b).

GRIFFITH—6,399[bis] (70).

HALLIER—2,786 (10).

HAMID—3,776 (35).

HANIFF—9,110 (1a), 13,257 (44e), 14,252 (48), 14,942 (72), 15,910 (34).

HANIFF & NUR—2,056 (35), 2,321 (25), 2,499 (36), 7,087 (54), 7,955 (28), 8,124 (24), 8,127 (39a).

HELFER—2,763 (54), 6,388 (54), 6,394 & 6,395 (54).

HENDERSON—10,732 (1b), 11,063 (30), 11,706 (30), 18,017 (30), 18,021 (14), 18,382 (72a), 18,465 (69), 19,427 (1a), 19,641 (39), 22,119 (19), 22,221 (1b), 22,716 (50), 23,028 (55), 23,125 (54), 23,380 (30), 29,583 (1b), 29,636 (1b), 29,842 (68).

HOLMBERG—842 (1b).

HOLTTUM—A (44f), 9,415 (70), 9,488 (13b), 9,882 (36), 9,912 (72), 9,944 (17), 10,670 (59), 10,786 (39), 10,974 (64), 15,211 (69), 17,696 (61), 20,586 (24), 21,558 (26), 24,565 (72), 37,395 (61).

HOLTTUM & FURTADO—19,786 (13).

HUME—7,302 (44c), 7,963 (36), 8,199 (1b), 8,281 (72), 8,509 (4), 9,591 (36), 9,666 (39).

JUNUS—16,403 (50).

KEITH—7,436 (51).

KIAH: 24,258 (1a), 32,310 (20), 32,387 (38), 35,996 (46).

KIAH & MOYSEY—31,802 (39), 31,830 (28), 31,891 (13a), 33,376 (6), 33,394 (36), 33,396 (36), 33,629 (36), 33,630 (44f).

KUNSTLER—3,931 (50), 5,527 (70), 7,136 (47a), 7,171 (51), 8,171 (58), 8,434 (70).

LUTJERHARMS—4,253 (44c).

MACHADO—cf. Ridley's nos.

MAT—cf. Ridley's nos.

NAUEN—38,068 (4).

NUR—517 (51), 1,307 (1b), 8,343 (4), 10,514 (39), 11,130 (64), 11,560 (47), 11,574 (36), 11,766 (36), 11,924 (1a), 11,961 (36), 12,188 (64), 18,783 (72a), 20,043 (38).

PARKER—2,407 (54).

PEARS—cf. Ridley's nos.

RAMOS—1,400 (3), 1,788 (3).

RIEDEL—1,876 (63).

RIDLEY—sn. A (1b), 577 (2), 1,661 (51), 3,475 (44b), 3,477 (1b), 3,478 (1b), 3,494 (25), 3,495 (70), 3,504 (71), 3,719 (13), 5,203 (25), 6,275 (2), 6,280 (70), 6,281 (17), 6,283 (13), 6,901 (71), 7,879 (39), 7,881 (70), 7,883 (4), 7,891 (48), 7,898 (72), 7,903 (1b), 8,405^{I} (37), 8,405^{II} (54), 8,777 (8), 9,207 (64), 9,467 (1b), 9,472^{I} (46), 9,472^{II} (72), 9,809 (36), 9,810 (1b), 9,814 (64), 9,815 (72), 9,850 (70), 10,118 (4), 10,119 (44b), 10,341 (72), 10,716 (16), 10,780 (38), 10,816 (13), 10,861 (70), 11,200 (72a), 11,202 (21), 11,203 (21), 11,206 (72a), 11,209 (38), 11,213 (38), 11,215 partly (72a), 11,215 partly (13), 11,216 (2), 11,220 (2), 11,300 (63), 11,304 (2), 11,314 (62), 11,315 (62), 11,338 (13), 11,382 (16), 11,410 (10), 11,411 (72), 11412 (72), 11,413 (25), 11,459 (72a), 11,460 (71), 11,473 (13), 11,481 (50), 11,515 (72a), 11,618 (51), 11,619 (13), 11,838 (51), 11,985 (25), 11,986 (36), 11,987 (64), 11,988 (15), 12,115 (26), 12,116 (39), 12,118 (60), 12,121 (31), 12,199 (67), 12,201 partim (4), 12,201 partim (47a), 12,202 (71), 12,403 (38), 12,404 (60), 12,590 (72a), 12,607 (65), 13,295 (44d), 13,299 (8), 13,301 (39), 13,338 (23), 13,339 (51), 13,450 (1b), 13,518 (44b), 13,914 (4), 13,920 (30), 13,921 (48), 13,922 (39), 14,114 (1b), 14,706 (44c), 14,707 (1b), 14,714 (72), 14,718 (50), 15,358 (33), 15,359 (55), 15,360 (54), 15,789 (31), 15,878 (28), 15,879 (31), 15,935 (28), 16,290 (24), 16,293 (39a).

SCHEBESTA—9 (1b).

SINCLAIR—39,991 (13).

SCORTECHINI—50[b] (15), 236[bis] (44a), 432[b] (14), 456 (16), 468[b] (58), 501[b] (51), 587[b] (50), 648[bis] (44a).

SEIDENFADEN—2,137 (54), 2,251 (35).

SPARE—3,738 (36).

SYMINGTON—22,885 (36), 24,198 (72), 24,206 (17).

SYMINGTON & KIAH—28,871 (39).

WALLICH—8,607 (54), 8,611 (53).

WRAY—454 (39), 981 (44e), 2,392 (17), 2,606 (44e), 3,017 (17), 3,460 (44c), 3,923 (29).

WRAY & ROBINSON—5,426 (28), 5,427 partim (24), 5,427 partim (39).

WYATT-SMITH—66,590 (14), 66,591 (30).

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The Malay prefix *Rotan* is sometimes omitted in giving the names of "malacca" canes, and sometimes, though rarely, is replaced by *Kayu* or *Pokok*. The prefix *Atap* is used when the leaves are used for thatch.

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A new Malaysian record in Lindernia (Ilysanthes) (Scrophulariaceae)

By M. Jacobs

Flora Malesiana Foundation

Lindernia tenuifolia (Vahl) Alston, Handb. Fl. Ceyl. 6 (Suppl.) (1930) 214.—*Gratiola tenuifolia* Vahl, Enum. 1 (1804) 95.—*Bonnaya tenuifolia* Spreng. Syst. 1 (1825) 42.—*Ilysanthes tenuifolia* Urban, Ber. Deut. Bot. Ges. 2 (1884) 435.

Malay Peninsula. Trengganu, Bt Chenering, SF 39845 (Sinclair), July 7, 1953, weed in paddy field, at seashore near road, 7th mile, leaves pale green, flowers pale blue, together with *Stylidium tenellum* Sw.

This is apparently a new record for Malaysia; the species was hitherto known to be widely distributed in S.E. Asia from Ceylon and India to Burma, Indo-China, and Formosa.

Racemobambos

A new genus of Bamboos

By R. E. Holttum

Among the bamboos from the Malay Peninsula in the Singapore herbarium is one from Gunong Pulai which has florets arranged as in Bambusa, and ovaries hardly distinguishable from those of Bambusa, but a specialized inflorescence-structure more like that of Arundinaria. The essential characters of this specimen are found also in *Bambusa gibbsiae* Stapf from Mt. Kinabalu in North Borneo, and in three other Bornean specimens, two from Kinabalu and one from G. Temabok in Sarawak, which represent undescribed species. All these together appear to me to form a natural genus, which I propose to call Racemobambos, because the spikelets are borne in a small raceme at the end of a leafy branch.

When describing *Bambusa gibbsiae*, Stapf stated that he would have placed it in the genus Arundinaria but for the presence of six stamens and "the shape of the pistil". He described the ovary as stipitate, subglobose, bearing a style divided almost to the base into three parts. I believe however that Stapf misinterpreted the structure, and that the stalk-like part is the true ovary (containing the ovule), the swollen hairy upper part being a sort of appendage bearing the three stigmas. In some species of Bambusa almost exactly the same structure occurs (e.g., *B. polymorpha*), but sometimes there is a distinct style bearing three stigmas (*B. vulgaris*). It appears that in Bambusa the upper part of the ovary, bearing the style (whether much wider than the base of the ovary or not) is always rather fleshy and hairy; in the fruit this upper part forms a fleshy part of the pericarp, easily separable from the top of the seed, the lower part of the ovary wall remaining thin and more closely adherent to the seed. In *Bambusa gibbsiae* the hairy stigma-bearing part is wider in proportion to the ovary proper than is usual in Bambusa. (A still more exaggerated condition is found in the genus Chloothamnus, in which the stigma-bearing part is a broad-based cone seated on top of a narrowly cylindrical ovary and remaining as a distinct structure in the fruit. Chloothamnus is specialized also in having a reduced spikelet; but I believe it is related to Bambusa, and have dealt with it in a separate paper in Kew Bulletin No. 4, 1955, pp. 591–594).

In its ovary therefore *Bambusa gibbsiae* is not clearly different from the true Bambusa species; and it agrees also in having several florets in each spikelet, the rachilla-internodes fairly long, and in having a rudimentary terminal floret. The rachilla is not so strongly flexuous as in Arundinaria, nor are the lemmas so wide as is normal in that genus. The difference from true Bambusa comes at the base of the spikelet, and in the arrangement of the spikelets.

In the Bambusa species, as in the genera Gigantochloa, Dendrocalamus and Schizostachyum, there is no sharp distinction at the base of the spikelet between empty glumes and bracts bearing buds in their axils; the spikelet is just the end of a small branch of a very condensed inflorescence, and McClure has proposed for such a structure the name pseudospikelet (Journ. Wash. Acad. Sci. 24: 541–548. 1934). McClure discussed only the genus Schizostachyum, but I see no essential difference in the other genera just mentioned. In *Bambusa gibbsiae*, and in the other species which will be described in this paper, the spikelets are distinct entities, as in an ordinary grass, each spikelet on a short stalk which is in the axil of a very small bract (this bract is normally absent in grasses*), and each spikelet having two (rarely three) empty glumes at the base, the glumes shorter than the lemmas and separated by very short internodes of the rachilla. The glumes are entirely different from the bracts in the axils of which spikelets are borne. These bracts are in all cases very small (about 1 mm. long) and the two-keeled prophylls which are normally present as the first leaves on axillary branches in Gramineae are lacking or not clearly distinguishable. The spikelets are usually at the ends of leafy branches, one spikelet terminal, with a few others in the axils of small bracts below it on the main axis, the whole forming a short raceme of spikelets. In one specimen of *Bambusa gibbsiae* however the spikelets are on short leafless branches straight from a main node. The specimen is not well enough preserved to show clearly the arrangement of the spikelets on the branches, but I think the arrangement does not differ in essentials from that on leafy branches.

Racemobambos, genus novum tribus Bambusearum; spiculae racemose dispositae, racemi in ramulis foliiferis terminales; spiculae laterales breviter stipitatae in axillis bractearum parvularum; spiculae multiflorae basi glumis 2 (vel 3) vacuis instructae, gluma inferior vulgo angusta, flos supremus imperfectus; internodia rachillae elongata, sub flores articulata; lodiculae plerumque 3, fimbriatae; stamina 6, filamenta libera, antherae non apiculatae;

* For a note on a grass which has all spikelets in the axils of small bracts, see Stapf in Hooker's *Icones Plantarum*, t. 3122 (1927).

ovarium parvum, cylindricum, appendicula tumida hirsuta ovoidea vel globosa supra instructum; stigmata tria tenuia fimbriata appendicula ovarii adjuncta; appendicula ovarii in fructu persistens.

Species typica: *Bambusa gibbsiae* Stapf in Journ. Linn. Soc. Bot. 42: 189. 1914.

The species are all slender bamboos of mountain forest, and some at least have relatively long culms which are not strong enough to support the weight of their branches, and so behave as lianes, but they have no special supporting organs. Probably, as in many slender bamboos (e.g., *Dendrocalamus pendulus*) the young unbranched and leafless culms can grow erect, at least to a considerable height, through other vegetation, and then are supported by their branches which grow outwards from the nodes and rest on other plants.

Another bamboo of this habit, and of doubtful genus, is *Arundinaria prainii* Gamble (originally called *Microcalamus prainii*) from the mountains of Assam. The spikelets of this are exactly like those of Arundinaria in the very flexuous rachilla and broad lemmas, but they have six stamens and the ovary is very like that of *Bambusa gibbsiae*, though the hairy stigma-bearing appendage is not much swollen. *A. prainii* differs from *B. gibbsiae* in the way the spikelets are borne, and in the nature of the lower part of each spikelet, and for this reason I do not think the two can be included in the same genus. In *A. prainii* the lateral spikelets are in the axils of bracts which are somewhat longer than the lemmas, and immediately at the base of the spikelet-stalk is a 2-keeled prophyll 6 mm. long, followed at a very short internode by a glume (or empty lemma?) 7–8 mm. long; then there is a rachilla-internode of normal length between the glume and the first flower-bearing lemma, which is also about 8 mm. long. It seems probable that Gamble's species should rank as a distinct genus, and there may well be others related to it in the same region (perhaps *Arundinaria mannii* Gamble, the flowers of which have never been described, is one of them).

The specimen from G. Pulai in Johore which is here described as a member of the new genus includes part of the base of the plant, showing a slender sympodial rhizome. The rhizome in Bambusa is always sympodial. In Arundinaria (in the broad sense of Gamble) the rhizome is often monopodial, and it is so in the genus Sasa, which has been separated because it has six stamens. I have no doubt that a sympodial rhizome is primitive in bamboos, so that Racembobambos is less modified in this respect than is Arundinaria.

I would thus regard the genus Racemobambos as an offshoot from Bambusa specialized in the form of the inflorescence and in the nature of the glumes at the base of the spikelet; specialized also perhaps to life in mountain forests (i.e., to a temperature-range lower than that of most Malayan bamboos).

The name bambos, derived from the widespread oriental (but not Malay) word bamboo, was used by Linnaeus in the binomial *Arundo bambos*, and later by Retzius as generic name (considered synonymous with Bambusa); it was treated by Retzius as feminine.

Key to the species of Racemobambos

All parts of spikelet (including palea) perfectly glabrous; leaves 2·5–3 mm. wide .. 1. *R. glabra*

Spikelets not perfectly glabrous; leaves wider

Lemma with setiform tip 3 mm. long .. 2. *R. setifera*

Lemma with setiform tip not over 1 mm. long

Lemmas hairy all over dorsal surface; small leaves on flowering branches at least 10 mm. wide, other leaves often wider .. .. 3. *R. hirsuta*

Lemmas hairy only on or near edges; leaves at most 7–8 mm. wide

Leaves 3·5–4 mm. wide; lower glume c. 5 mm. long, 5-veined; rachilla-internodes 5 mm. long 4. *R. gibbsiae*

Leaves 7–8 mm. wide; lower glume 12–15 mm. long, 1–3-veined; rachilla-internodes 6–7 mm. long .. .. 5. *R. rigidifolia*

1. **R. glabra** Holttum, sp. nov.

Laminae foliorum 4–10 cm. longae, 2·5–3 mm. latae, praeter pili pauci breves rigidi supra prope marginem glabrae, auriculae setas tenues 5–6 mm. longas ferentes, ligula humilis; ramuli spiculas ferentes glabri, stipites spicularum axillarium 1–3 mm. longi, spicularum terminalium 5–10 mm. longi; spiculae omnino glabrae; glumae vulgo 3, infima 1–1·5 mm. longa (spiculae terminalis 3 mm. longa), secunda 4–5 mm. longa, 9-venosa, obtusa, tertia 6·5 mm. longa, 11-venosa; rachillae internodium inter glumam tertiam et lemma primum 1 mm. longum, internodia cetera 4–5 mm.

longa; lemmata 7·5 mm. longa, tenuia, obtusa; paleae paulum breviores, omnino glabrae; lodiculae c. 1·5 mm. longae; antherae 3·5–4 mm. longae.

TYPE: Sarawak, G. Temabok, Upper Baram River, leg. J. C. Moulton (S.F.N. 6797), in Herb. Singap. et Kew.

Parts of culms seen 3–4 mm. in diameter, internodes 15–18 cm. long, no sheaths seen; many slender leafy branches about 15 cm. long from each node. This species is notable for its very narrow leaves and quite glabrous spikelets.

2. **R. setifera** Holttum, sp. nov.

Laminae foliorum 10–18 cm. longae, 8–12 mm. latae, infra pilis paucis 1 mm. longis instructae, breviter petiolatae (petioli haud 1 mm. longi); auriculae paulum elevatae, setas tenuas flexuosas ferentes; ligula parva. Spiculae axillares paucæ, breviter stipitati (stipites 2–3 mm. longi); glumae 2, inter se 1 mm. distantes; gluma inferior 6 mm. longa, 1 mm. lata, 1-venosa, fimbriata; gluma superior 10 mm. longa, 2·5 mm. lata, 9-venosa, fimbriata, apice leviter carinata non apiculata; rachilla inter glumam superiorem et lemma primum 1·5 mm. longa, inter lemma primum et lemma secundum 3 mm., internodia cetera rachillae c. 4·5 mm. longa; lemmata 14–15 mm. longa, apice setiforme 3 mm. longo instructa, margine fimbriata; paleae c. 10 mm. longae, apice breviter bifidae, carinae apicem versus breviter fimbriatae; lodiculae 3, 3 mm. longae, fimbriis 0·5 mm. longis inclusis; antherae 5 mm. longae; ovarium c. 0·8 mm. longum, appendicula paulum tumida supra attenuata c. 2 mm. longa.

TYPE: Johore, Gunong Pulai, leg. G. A. Best (S.F.N. 7707), in Herb. Singap.

Rhizome sympodial, creeping, horizontal length between one culm and the next c. 10 cm., 5–10 mm. diameter, internodes 5–10 mm. long; culms seen less than 10 mm. diameter, length not recorded, sheaths not known; leafy branches 20–25 cm. long, bearing 5–8 leaves and sometimes spikelets at the apex, the spikelet-bearing part of the branch little longer than the last leaf-sheath.

The swollen stigma-bearing ovary-appendage is unusually slender and attenuate. The only flowering specimen bears few spikelets. A probable second specimen, sterile, was collected by Ridley (no. 10991, in Herb. Singap.) at Minyak Buku, Johore (near Batu Pahat); the altitude of collecting was not recorded, but the hills near Batu Pahat are little over 1,000 ft. (G. Pulai is 2,000 ft.).

3. **R. hirsuta** Holttum, sp. nov.

Laminae foliorum 5–14·5 cm. longae, 10–18 mm. latae, supra prope basin medio breviter hirsutae, latitudo maxima foliorum minorum prope basin rotundatum, apicem versus sensim decrescens; auriculae humiles setas tenues ad 5 mm. longas ferentes. Extremi ramuli spiculas ferentes rigidi, dense breviter hirsuti; spiculae axillares ad 6, breviter stipitatae (stipites 2–3 mm. longi), bracteae c. 1 mm. longae; gluma inferior 10 mm. longa, 1 mm. lata, dorso leviter hirsuta; gluma superior 12 mm. longa, c. 3 mm. lata, prope apicem fimbriata; internodia rachillae 4–5 mm. longa, pilis paucis brevibus instructa; lemmata 8–12 mm. longa (inferiore longiora), dorso pilis brevibus appressis margineque fimbriis 0·5 mm. longis vestita, apex setiformis 0·5 mm. longus; paleae 7–9 mm. longae, dorso in sulco dense pilosae, carinae apicem versus fimbriatae; lodiculae parvae; antherae 3–4 mm. longae; fructus immaturus 6 mm. longus, appendicula stigmatifera 0·6 mm. longa inclusa.

TYPE: N. Borneo, Mt Kinabalu, Penibukan Ridge, 4,000–5,000 ft., leg. Clemens, s.n., 15 Jan. 1953, in Herb. Singap.

No part of the culm is preserved in the type specimen. This species was found at the same locality as *R. rigidifolia*, but differs in the stouter spikelet-bearing branches, larger leaves, shorter less hairy rachilla-internodes, shorter and much more hairy lemmas and paleas. These differences seem sufficient to warrant the establishment of two species, but it may be that the specimens represent different members of an inter-breeding heterozygous group.

4. **R. gibbsiae** (Stapf) Holttum, comb. nov.

Bambusa gibbsiae Stapf in Journ. Linn. Soc. Bot. 42: 189. 1914.

Stem scandent; one culm-sheath seen 15 cm. long, 5 cm. wide at the base (culm therefore 12 mm. diameter), narrowed to an apex 2 mm. wide, blade broken off, no apparent auricles. Leafy branches to about 12 at a node, 12–15 cm. long, bearing up to 8 leaves and sometimes a few spikelets at the apex; spikelets sometimes also borne in close groups on short stalks directly from nodes of a leafless (main?) stem. Leaves on one specimen 4–6 cm. long, on another 10 cm. long, in both cases 3·5–4 mm. wide, glabrous, auricles small, bearing slender bristles 4–5 mm. long. Lateral spikelets on ends of leafy branches short-stalked, in axils of small bracts; perfect florets about 3, rachilla-internodes 5 mm. long, nearly glabrous (few hairs near top only); glumes 2, lower 5 mm. long, 5-veined, short-fringed, upper 7–8 mm. long, 7-veined; lemmas 10–11 mm. long, thin, with 7–9 prominent veins,

slightly hairy near edges, tip a seta less than 1 mm. long; palea hairy on back in groove and on keels towards apex; lodicules 3, small; anthers 5 mm. long; ovary narrow, with subglobose hairy apical appendage bearing 3 stigmas.

DISTRIBUTION: known only from two localities on Mt Kinabalu, N. Borneo, collected by L. S. Gibbs, specimens in Kew Herbarium (Marei Parei Spur, 5,000–8,000 ft., no. 4091, and Kamburangah, 7,000–9,000 ft., no. 4232).

Stapf described the ovary as globose and stipitate, but by comparison with other related species (notably *R. hirsuta*, of which I have seen a young fruit) it is certain that the "stipe" of Stapf is the true ovary.

5. **R. rigidifolia** Holttum, sp. nov.

Culmus speciminis typici 5 mm. diametro, internodium solum 21 cm. longum; vaginae culmorum ad 7·5 cm. longae, apice angustae; lamina vaginae maximae non visa, lamina vaginae parvae erecta 5 mm. longa, haud 1 mm. lata, auriculae perparvae, ligula humilis; ramuli foliosi c. 20 cm. longi, pauci (semper?); laminae foliorum rigidae, 6–8 cm. longae, 7–8 mm. latae, basi rotundatae, e basi apicem versus sensim attenuatae, costa supra basin versus breviter hirsuta, petiolus haud 1 mm. longus, auriculae leviter arcuatae, setas paucas tenues 2–3 mm. longas ferentes, ligula haud 1 mm. alta, margine interdum pilos ferens. Spiculae more eorum R. hirsutae in ramulis hirsutis dispositis (pili ad 0·3 mm. longi); glumae angustae, apicem versus sensim attenuatae, apex non setiformis; gluma inferior 12–15 mm. longa, c. 1·2 mm. lata, 1–3-venosa, gluma superior 15 mm. longa, 3 mm. lata, 9-venosa; internodia rachillae 6–7 mm. longa, breviter pilosa; lemmata 11–14 mm. longa, apice setiforme 1 mm. longo instructa, praeter fimbriae prope apicem glabra; palcae paulum breviores, dorso inter carinas minute pilosae (pili 0·1 mm. longi), carinis copiose fimbriis 0·3 mm. longis vestitae; lodiculae 3, 2·5 mm. longae; antherae 6 mm. longae; ovarium 1 mm. longum, angustum, appendicula tumida quam ovarium latior, stigmata 5 mm. longa (unum interdum parvum).

TYPE: N. Borneo, Mt. Kinabalu, Penibukan Ridge, 4,500 ft., leg. C. E. Carr (S.F.N. 27438) in Herb. Singap.

This specimen is from the same locality as the type of *R. hirsuta*; see comment under that species.

The study on which this paper is based was carried out in the herbarium and library at the Royal Botanic Gardens, Kew. I wish to express my thanks to the Director for permission to work in the herbarium, and to Mr. C. E. Hubbard for helpful discussions on this and other aspects of the study of bamboos.

Two new Bamboos from the Malay Peninsula

By R. E. Holttum

Schizostachyum terminale Holtt., sp. nov.

Culmi speciminis typici 1 cm. diametro; vaginae culmorum 13 cm. longae, tenues, pallidae, dorso pilis pallidis appressis vestitae, summa vagina ad laminam et auriculas juncta fere triangularis (apice rotundata); auriculae 5 mm. latae, 2 mm. altae, setas flexuosas confertas 5 mm. longas ferentes; lamina erecta, anguste triangularis, c. 8 cm. longa, basi haud 10 mm. lata, marginibus inflexis, supra basin versus pilis appressis vestita; ligula parva. Laminae foliorum 16–20 cm. longae, 2·7–4·2 cm. latae, glabrae, superiores petiolis 3–4 mm. longis sustentae; ligula humilis; auriculae interdum setas 5 mm. longas ferentes. Spiculae solitariae apices ramulorum foliosorum formantes, angustae, teretes, 4–5 cm. longae, 4–5 floribus perfectis et 1–2 imperfectis constructae; internodium infimum rachillae 4 mm. longum, internodia cetera c. 7 mm. longa; lemmata glabra, 15 mm. longa, apice setiforme 1 mm. longo instructa; paleae paulum longiores, 2-carinatae (carinae pilis brevibus rigidis ornatae) apice 2-aristatae, aristae 0·5 mm. longae; lodiculae 3, 5 mm. longae, hyalinae, apicem versus minute punctatae, non fimbriatae, una symmatrica 2 mm. lata, duae asymmetricae augustiores; stamina non visa; stylus in anthesi quam palea paulum longior; fructus 25 mm. longus stylo rigido persistente incluso.

Type: Kedah, Sungei Krian, Inchong Estate, river edge, leg. J. C. Nauen, S.F.N. 35821.

The spikelet-structure of this species does not differ in essentials from that of *S. grande* Ridl.; the principal clear difference is in the ciliate keels of the paleae in *S. terminale*. The apex of the spikelet examined is still incompletely developed, and the nature of the terminal imperfect floret is thus uncertain. *S. terminale* differs strikingly from *S. grande* in its vegetative habit, being much smaller, with smaller leaves, and in the position of the spikelets which (so far as observable in the type specimen) are exclusively solitary and terminal on leafy branches. *S. grande* is a very common bamboo in forest at moderate elevations on the Main Range in Malaya. I have examined many specimens, both in the field and in the herbarium, and have no doubt that Mr. Nauen's collection represents a distinct species.

Gigantochloa ridleyi Holttum, sp. nov.

Culmi ad 16 m. alti, 10 cm. diametro, glabri, virides; vaginae culmorum longe persistentes, ad 25 cm. longae, dorso pilis fere nigris appressis vestitae, apice extus in laminam insensibile transgredientes; laminae non deciduae, erectae, in juventute ad culmum appressae, triangulares, vaginarum mediarum c. 8–10 cm. longae, 6 cm. latae, fusco-pilosae, basi non angustatae sed in auriculas humiles rigidas decurrentes; laminae margine basin versus setas breves arcuatas ferentes, auriculae setis similibus prope laminam ornatae; junctio vaginae et laminae arcuata; ligula ad 3 mm. alta, fere integra, margine aliquantum undulata, leviter dentata, non setifera. Laminae foliorum ad 40 cm. longae et 6 cm. latae, infra praeter pili pauci prope costam glabrae, petioli laminarum inferiorum 4–5 mm. longi, laminarum superiorum 10 mm. longi; vaginae juveniles hirsuti, auriculae parvae glabrae, ligula humilis, integra.

TYPE: cult. Hort. Bot. Singap., lawn W, leg. J. L. Pestana in Herb. Singap. et Kew.

The plant from which the type specimen was taken was brought by Ridley from Province Wellesley to Singapore, at a date not recorded. The Singapore plant now forms a large clump, and in more than 40 years has not been known to flower. The auricles and ligule of the culm-sheaths are very like those of *Gigantochloa verticillata* (sensu Backer), for which reason I have no doubt of the genus; but I have never seen another Gigantochloa with the peculiar broadly triangular, erect, persistent culm-sheath-blades, nor have I found any such described. The original plant in Province Wellesley was in a village, not wild, and probably came from further north, as I believe other village Gigantochloas have done, brought by man. I once saw a plant near Kota Tinggi, Johore, which was very similar to the type plant of *G. ridleyi*, but I did not take a specimen.

Some Javanese gardeners at the Botanic Gardens, Singapore, who are connoisseurs of edible bamboo-shoots, told me that the shoots of this bamboo are astringent. The culms are strong and quite large, and would doubtless be useful for constructional purposes like those of *G. verticillata.*

The effect of fruit sap on the germination of four species of Tropical Plants

By Anne Garrard

Introduction

When the seeds of *Fagraea fragrans* Roxb. are extracted from their berries, washed thoroughly, dried and placed on damp filter paper, soil or any other media they do not germinate. Gardeners in Singapore obtain germination by squashing the whole berry and placing it in a pot of soil. It seems possible that the tissue which surrounds the seed in the berry contains some substance which is essential for the germination of these seeds. An investigation was made to determine more exactly the conditions necessary for germination and for their rapid growth under laboratory conditions. This led to investigation of three other plants with juicy fruits:—*Melastoma malabathricum L, Muntingia calabura L.* and *Duranta plumieri Jacq.*

The seed-coats of all four species of plants investigated are readily permeable to water. Except for *Duranta plumieri Jacq.* the seeds themselves are very small in size and counts of number of seeds germinated were made with a binocular microscope.

Investigation of the conditions necessary for germination.

1. **Fagraea fragrans** Roxb.

Fagraea fragrans Roxb. has beautiful scarlet berries which are about ½″ in diameter. The trees in Singapore generally have two crops—one in September and one in January. The results given below were obtained using seed from the September crop of 1952 and the two crops in 1953. There was no significant difference between them. Great care was taken to select only ripe berries. Since the berries take nearly three months to mature there is a good number of intermediate stages. Ripe berries are bright scarlet in colour and are easily separable from the persistant calyx by a touch of the finger. Fallen berries were not used since it was impossible to be sure of the time they had lain on the ground and whether they had suffered any damage in their fall.

Gathered berries were squashed in some tap water with a pestle and mortar. Despite their small size the seeds were heavier than the water and berry tissue, and tended to form a bottom layer

which could be separated. The seeds were washed six or seven times with tap water and were filtered off, washed with distilled water, dried with filter paper and allowed to dry out for 24 hours. They were then completely free from sap and berry tissue.

In the above procedure the concentrated sap was retained and was diluted to a concentration 1 in 10, 1 in 100, 1 in 1,000. Fresh dry seeds were placed on filter paper in petri-dishes with distilled water and sap of each of the three concentrations above.

Other samples were placed with sap which had been filtered through Watman's No. 1 filter paper, and others with sap which had been both filtered and boiled. Table I gives the results.

TABLE I. PERCENTAGE GERMINATION OF SEEDS OF FAGRAEA FRAGRANS
(Samples contained approximately 100 seeds)

Water	Sap 1 in 1,000	Sap 1 in 100	Sap 1 in 10
0	90	92	93
Filtered Water	Filtered Sap 1 in 1,000	Filtered Sap 1 in 100	Filtered Sap 1 in 10
0	91	95	90
Boiled Water	Boiled Sap 1 in 1,000	Boiled Sap 1 in 100	Boiled Sap 1 in 10
0	95	90	96

From the above it is seen that there is no germination of washed, dried *Fagraea fragrans* seed in distilled water, but when the seed is provided with sap extract germination takes place readily. It is immaterial whether the sap is 1 in 1,000, 1 in 100, or 1 in 10 in concentration for they are all equally effective. The highest concentration (1 in 10) is rather syrupy and liable to fungal contamination during the experiment. The active principle for germination passes through ordinary filter paper since if any of the extracts are filtered they still are able to induce germination. Moreover, if the filtered extracts are boiled they still remain active. It seems that the active principle is soluable and thermostable in boiling water.

It may be stated here that tap water does not promote germination of these seeds and similar results are obtained throughout whether distilled or tap water is used.

If crushed or whole berries are planted in damp soil germination of the seed takes place in 12 to 14 days. It would seem that fallen fruit or fruit transported uneaten away from the tree by animals such as birds or bats would stand a good chance of germination provided the conditions were otherwise favourable.

The pH of the undiluted berry sap is in the region of 5·5–6·0. It was conjectured that a low pH might alone be the principle needed for germination of these seeds. Consequently a series of solutions of varying pH were made up in distilled water using M/5 solutions of sodium acetate and acetic acid. The pH values of these solutions varied by 0·5 unit intervals over a range of 3·5–7·0 units. Using washed dried seed it was found that germination did not occur at any of these pH's. Assuming that neither acetate or sodium ions are in themselves inhibitory to germination of these seeds it seems that the effect of berry sap is not merely a pH effect.

There have been reports (Barton 1940) that natural and synthetic auxins have a stimulatory effect on seed germination. The seed was therefore tested with a range of concentrations of 3-indole acetic acid in neutral solution from 1 part in 10^5 to 1 part in 10^{11}. No concentration was effective in promoting the germination of washed dried seeds. However, when other seeds were placed in the refrigerator at approximately 10°C and removed after a period of 1, 2, 7 or even 21 days, and then placed on filter paper with distilled water, germination of most of the seeds occurs after about 14 days at room temperature. The seeds were refrigerated in both a dry and wet condition and both samples germinated in subsequent tests.

For the purpose of sending seed samples abroad it was considered profitable to note the behaviour or washed dried seed which had been stored in a dry state for 10 days prior to germination tests. This seed was found not to germinate in distilled water alone. At the same time that the seed was extracted the berry sap was retained separately, diluted to 1 part in 100 and 1 part in 1,000 and autoclaved at 20 lb. for 30 minutes. This extract which was stored in conical flasks plugged with cotton wool remained free from contamination over the 10 day period. These extracts were added to the dry, 10 day old berry seed and a good percentage germination was obtained in both cases. But it may be somewhat inconvenient to send a quantity of autoclaved sap together with the dried seed. Germination can be more easily effected in 10 day old seed by placing it in the main body of a refrigerator (10°C) for a period of one or two days when germination occurs readily after 14 days at room temperature.

Berries were kept for 10 days attached to small branches and appeared but slightly shrivelled at the end of this period. The seed was extracted, washed and dried as before and the sap of these 10 day old berries retained for testing. The dried seeds would not germinate in distilled water. Moreover their own berry sap was

not effective in promoting germination. The seeds were not however inviable and germinated if they were first in a refrigerator for two days, or supplied with berry sap from freshly gathered berries. It seems that the active principle which can promote germination in berry sap is lost if the berries are first plucked and stored for 10 days. As before stated the active component is not lost if the sap is extracted, autoclaved and stored for the same period.

Berries were dried in a steam oven and then stored for a 10 day period. The seed was then extracted, washed and dried as before and the sap retained separately. The seed would not germinate in distilled water alone, or if given their own berry sap (1 part in 100), or if given freshly prepared berry sap (1 part in 100) or if given autoclaved sap which had been prepared from berries 10 days previously, or if placed in a refrigerator prior to germination tests. The 100°C treatment had rendered the seed inviable and moreover had destroyed the active principle for germination in the berry sap since this was not effective in promoting the germination of freshly extracted seed. Similarly if the seed is autoclaved together with its own diluted sap, it is rendered inviable but in this case, as mentioned above, the sap extract remains active to viable seed.

II. Muntingia calabura L.

Like *Fagraea fragrans* the fruit of the *Muntingia calabura* is a berry containing small seeds. The berries have a somewhat larger diameter and are at first green, turning through pink to a deep red or black. If they are not eaten by children, birds or bats they decay becoming brown in colour. We did not know what stage would be best to obtain a good and easily repeatable germination, and experimented on seeds taken from green, red, and "decayed" berries with distilled water and with extracts of their own berry sap. The following results are the means of three complete experiments.

TABLE II. PERCENTAGE GERMINATION OF SEEDS OF MUNTINGIA CALABURA
(Seeds washed thoroughly to remove sap and adhering tissue)

Seeds from	With water	With Green Berry sap	With Red Berry sap	With "Decayed" Berry sap
Green Berry ..	24.0	8.3	10.5	3.9
Red Berry ..	23.3	9.5	6.3	3.1
"Decayed" Berry ..	61.5	3.3	4.7	0.0

From the above it is seen that the "decayed" fruit seed gives a much better percentage germination than that from green or red fruit. It is surprising that there is no difference in the percentage germination of the green and red berry seed. The sap from all three berries seems to be inhibitory. The dilution used in the above experiment was 1 in 100, but as a check seed from the "decayed" fruits was treated with sap diluted to 1 in 1,000. Inhibition still occurred.

Since the fruit of this tree is dispersed by fruit bats which eat the succulent portion and spatter pink masses of small yellow seeds (Corner 1952) the Muntingia sap may not have so great an inhibitory effect in nature.

III. Melastoma malabathricum L.

Melastoma malabathricum has a succulent fruit rather like a berry, but which opens when ripe by an irregular split. The unripe fruit is green and ripens to a red colour containing a purplish sap and a mass of small seeds. Three stages were used in the following experiments; green fruits, red but undehisced fruits and red dehisced fruits. All gave a good percentage germination in distilled water (the seeds were carefully washed to remove any adhering sap). They were also tested with suitably diluted sap extracts. Table III gives the results for seed taken from green fruit which had swollen to their maximum size. The percentage germination is somewhat variable but it can be seen that the sap has no significant effect on the germination of the seed.

TABLE III. THE PERCENTAGE GERMINATION OF SEED FROM GREEN, UNDEHISCED FRUIT WITH SAP EXTRACTS FROM ITS OWN FRUIT

Distilled Water	Sap 1 in 1,000	Sap 1 in 100	Sap 1 in 10
70.8	78.0	61.5	75.1
Filtered	71.8	77.2	82.4
Boiled and Filtered	60.0	73.7	76.9

In the case of the red, undehisced fruit the 1 in 10 sap has an inhibitory effect on germination. This effect is removed by boiling and filtering the extract.

TABLE IV. THE PERCENTAGE GERMINATION OF SEED FROM RED, UNDEHISCED FRUIT WITH SAP EXTRACTS FROM ITS OWN FRUIT

Distilled Water	Sap 1 in 1,000	Sap 1 in 100	Sap 1 in 10
72.7	69.2	72.2	34.6
Filtered	66.1	74.5	48.2
Boiled and Filtered	61.6	66.7	62.4

Similar results were obtained from fruits which had dehisced.

TABLE V. THE PERCENTAGE GERMINATION OF SEED FROM RED, DEHISCED FRUIT WITH EXTRACTS FROM ITS OWN FRUIT

Distilled Water	Sap 1 in 1,000	Sap 1 in 100	Sap 1 in 10
64.6	68.4	69.6	35.4
Filtered	54.2	63.2	25.2
Boiled and Filtered	66.4	65.6	58.2

IV. Duranta plumieri Jacq.

Duranta plumieri Jacq., has small orange berries containing a small number of hard seeds which are about 1/10 inch long. These seeds are considerably larger than any of the three types described above and occur in a much smaller number per fruit. Whereas the results given above are based on samples of 200–400 seeds, the following results are based on smaller samples each of only 20 seeds. They are included since Duranta is intermediate in behaviour between Melastoma (where dilute sap has virtually no effect on germination) and Muntingia (where the sap is definitely inhibitory).

TABLE VI. THE PERCENTAGE GERMINATION OF DURANTA SEEDS (Time of germination 20–25 days)

Distilled Water	Sap 1 in 1,000	Sap 1 in 100	Sap 1 in 10
20	20	10	0

Since the endocarp of Duranta is relatively hard it was thought germination might be increased by scarifying the coat. This was not so and the percentage germination of scarified seed was still only 20 per cent.

If the seed of Duranta is kept in the refrigerator at approximately 10°C for two days in either wet or dry condition it does not germinate on removing to room temperature. Unlike Fagraea the cold temperature does not increase the germination but inhibits it altogether.

V. Effect of alien sap on seed germination

Although Duranta sap inhibits the germination of Duranta seed it can promote the germination of the seed of *Fagraea fragrans*. The following are the results:—

TABLE VII. THE EFFECT OF DURANTA SAP ON FAGRAEA FRAGRANS SEEDS

With distilled water	With Duranta sap 1 in 1,000	With sap 1 in 100
0	38.3	22.7

It is to be noted that Duranta sap is not nearly as effective as the sap of Fagraea itself, which gives 90–96 per cent germination.

Fagraea fragrans sap is not always stimulatory since the germination of seeds of the split red fruits of *Melastoma malabathricum* is inhibited. The germination of seeds from the green and red unsplit fruits is not affected.

TABLE VIII. THE EFFECT OF FAGRAEA FRAGRANS SAP ON MELASTOMA SEEDS
(Results are means of three replications)

	Distilled Water	Sap 1 in 100
Green fruit seed ..	70.8	70.8
Red fruit seed ..	72.7	64.4
Red dehisced fruit seed ..	64.6	36.7

The fruit saps of the four plants above no doubt vary greatly in composition and their effect is modified by individual properties of the four types of seed. It is unlikely that the stimulatory and

inhibitory effects described above are the result of any single substance or group of substances present in the fruit saps.

The presence of fruit sap may somewhat modify the percentage germination of seeds. Succulent fruits are generally attractive to animals which effect dispersal. The succulent portion may be eaten and the seeds ejected or swallowed. In the latter case they may still remain viable after passing through the alimentary canal. In *Muntingia calabura L.* the fruit sap is inhibitory to seed germination, and animals which eat the succulent portion and spit out the small seeds may perform a useful service in separating the seed from at least some of the inhibitory sap. In *Melastoma malabathricum L.* this is not important to subsequent germination since the fruit sap is not inhibitory. In the case of *Duranta plumieri Jacq.* the inhibitory effect of the sap is not as marked as in *Muntingia calabura L.* and removal of the fleshy part of the fruit by animals may not be so important. Incidentally, the berry of *Duranta plumieri Jacq.* is slightly poisonous to man. It does not however follow that it is poisonous to all animals.

The germination of the seed of *Fagraea fragrans Roxb.* is of some interest. It is generally believed that the fruit is eaten by fruit bats (Corner 1952) in which case the fruit sap which promotes germination of uneaten berries is presumably destroyed. The bats may however drop a sufficient number of uneaten berries to provide a sufficient means of dispersal. Alternatively seeds which have passed through the alimentary canal of a bat may be able to germinate in the absence of fruit sap due to physiological change caused by the fluids of the alimentary canal. We have no evidence on this point. Seeds which have not been eaten can only germinate if the berry seed falls or is dropped by a bat or bird onto favourable ground and is crushed to expose the seeds. If the seeds remain ungerminated for 10 days the fruit sap is no longer able to promote germination of the seed.

Concerning the cold temperature treatment of *Fagraea fragrans* seeds it is unlikely that this can be a factor in nature. If washed seeds are placed in an air-conditioned room at approximately 75°F for a day, they do not germinate on removal to room temperature. Temperatures do sometimes fall below this figure, especially in February which may coincide with the fall and dispersal of the January crop. There is no cold temperature period following the July crop of berries. Further experiments at a range of temperatures are necessary to determine the relationship between germination and cold temperature treatment.

References

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Summary

1. Freshly washed and dried seeds of *Fagraea fragrans Roxb.* do not germinate on filter paper in distilled water.

2. If a diluted extract of the berry sap is added there is a 90–96 per cent germination in 12–14 days.

3. The "active principle" causing germination is filterable and thermostable at 100°C. It is not hydrogen ion concentration or an auxin.

4. Germination can also be effected on washed dried seed by refrigeration at 10°C at periods of 1–21 days prior to the germination test.

5. Ten day old seed will germinate if supplied with 10 day old berry sap which has been autoclaved and stored; or if refrigerated prior to testing.

6. The washed dried seed of *Muntingia calabura L.* give 61·5 per cent germination on filter paper in distilled water when fully ripe, but this germination is inhibited by sap extracts from its own fruit.

7. The germination of the seed of *Melastoma malabathricum L.* is unaffected by sap extracts from its own fruit.

8. The germination of the seed of *Duranta plumieri Jacq.* is inhibited by berry extracts at high concentrations but unaffected at lower concentrations.

9. From the effect of alien sap on seed germination it is likely that the active principle affecting the germination of these seeds is the same in all cases.

Calophyllum Linn.

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AND
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The following account of the Malayan species of the genus is not by any means a final one, for much more collecting is needed before several of the groups can be properly defined. As, however, the genus is of some importance as a timber tree and as the existing accounts of it are out of date (Ridley in Flora of Malay Peninsula, I, 1922, pp. 181–91 gives only 24 species, several of which we do not consider valid) and far from satisfactory particularly in the matter of field notes, it was thought necessary to prepare a preliminary account based on existing collections. It is sincerely hoped that this paper will encourage foresters and other field botanists to intensify collecting of material of this important and interesting genus, and that they will pay particular attention to the section on miscellaneous field notes and inform the second author of errors and omissions of which they become aware. Field, in contrast to the standard floral characters, appear to be of much greater importance in this genus in differentiating species and no apologies are offered at this stage for the omission of a key based on floral characters.

Usually *trees*, sometimes shrubs (*C. rupicolum*). *Bole* usually without buttresses, occasionally with stilt roots. *Bark* usually smooth with diamond or boat-shaped lenticellate fissures (very characteristic of the genus) in immature trees and longitudinally fissured, frequently with coarse anastomosing ridges, in mature trees grey or yellowish brown in colour. *Slash:* inner bark pink or reddish, laminated, with clear, colourless, golden or yellow-coloured or opaque milky white, sticky or non-sticky, varnish-like exudate. Youngest *twigs* generally quadrangular. *Leaves* opposite, simple, entire, often coriaceous, lateral nerves numerous, slender, close together and parallel, usually nearly at right angles to the midrib, petioles nearly always present.

Inflorescences often copiously produced, axillary or terminal, paniculate or racemose; *flowers* usually numerous, but sometimes the inflorescence reduced and consisting of 1, 2 or 3 flowers (e.g. *C. gracillimum*, *C. biflorum*), *sepals* 4, decussate, *petals* 2 or

more, or absent, resembling the sepals, *stamens* numerous, filaments slender, free or slightly joined at base, often flexuous, *ovary* superior, 1-locular, style slender, stigma peltate. *Fruit* a drupe with a single erect seed; usually green with pale yellow green or darker green spots.

This large genus is distributed mostly in tropical Asia, with some American species. It is at once recognisable by the close and parallel venation of the leaves. This venation at first sight appears very much the same in all species but a closer examination reveals differences which are diagnostic. These differences are small and difficult to describe or to illustrate, and consist in the number of nerves per millimetre, whether they are raised or incised, clearly cut or indistinct. There is also great similarity in the flowers of the various species, the main differences being in size, presence or absence of petals and the presence or absence of tomentum on the sepals. We have ignored the classical division of the genus into petalous and apetalous sections. It appears to us very doubtful whether such a division is valid, even, sometimes, as a specific character; and we consider that it would probably be more satisfactory to discard the terms sepals and petals and to regard the floral envelope as made up of a varying number of whorls of tepals. However, in our descriptions we have followed the general practice of regarding the outer 4 floral leaves as sepals and anything within them as petals. More important diagnostic characters are undoubtedly those of the inflorescence, fruit and vegetative buds, but much more information on these points remains to be collected. For field workers, bole and bark characters, colour of exudate, habitat, and shape, size, texture and venation of leaf are important.

The genus is distributed throughout the Malay Peninsula though it is particularly common in the southern half. Species occur in nearly all habitats—beach forest, freshwater swamps, peat swamps, lowland forest, riparian forest, hills and mountains up to about 6,000 ft. (*C. aureo-brunnescens*), but the commonest habitat appears to be low-lying forest. The only collection from limestone is a single very incomplete one from Bukit Cheras at about 600 ft., *Henderson s.n., 11-10-31*, which we have been unable to match. The richest area of *Calophyllum* forest in the Malay Peninsula that we know of is Jemaluang Forest Reserve in south-east Johore, where *Calophyllum* is certainly the dominant genus amongst the large trees.

Calophyllum species are commonly known by the vernacular tree name of *bintangor*, which is often, apparently somewhat indiscriminately, qualified by such epithets as *bunga, lilin, batu.*

Exceptions to the above are *C. inophyllum*, which is always known as *penaga laut*,[1] and *C. sclerophyllum*, which is frequently known as *penaga bayan*, though it has also been collected under the names of *penaga* and *penaga ayer*.

Nearly fifty species occur in the Malay Peninsula and of these about twenty are known to reach timber size (4 ft. girth at breast height), though several of them do not reach a girth much greater than 4–5 ft. These are regularly worked by hand-sawers and in sawmills, and for local purposes are not differentiated from Meranti (medium to light weight grade of timber produced by many species of *Shorea*), although a few species, e.g. *C. inophylloide*, *C. sclerophyllum*, have harder and heavier timber than usual in the genus and are known locally as *bintangor batu* in consequence. Some species are popular as poles and in demand by local fishermen as masts.

Since the war and particularly in Johore the volume of Bintangor[2] sawn in the mills has increased enormously. In 1950 nearly 200,000 cu. ft. were sawn in Johore making it the sixth commonest timber sawn and exceeded only by Kempas (*Koompassia malaccensis*) of the non-Dipterocarp timbers, and in Perak 136,000 cu. ft., making it the fourth commonest timber sawn and exceeded only by Terentang (*Campnosperma* spp.) of the non-diptercarp timbers. In 1951 the amount of Bintangor sawn in Johore sawmills was reduced to a little over 168,000 cu. ft., in 1952 it rose to nearly 247,000 cu. ft., dropping in 1953 to nearly 212,000 cu. ft.; during these years it was the fifth commonest timber and again exceeded only by Kempas of the non-dipterocarp timbers; during 1954 the amount sawn dropped to 168,000 cu. ft., when it was the seventh commonest timber and exceeded only by Kempas and Punah (*Tetramerista glabra*) of the non-dipterocarp timbers. In 1952 in Perak 139,000 cu. ft. were sawn in the mills but it was only the eleventh commonest timber sawn, though in the first six months of 1954 it was exceeded only by Kempas and Merbau (*Intsia palembanica*) of the non-dipterocarp timbers.

We gratefully acknowledge the loan of herbarium material from the Royal Botanic Gardens, Kew; Kebun Raya Indonesia, Bogor; the Indian Botanic Gardens, Calcutta; and the Rijksherbarium, Leiden. The large collections in the Herbaria of the Botanic Gardens, Singapore (prefixed *S.F.N.*) and of the Forest Research Institute, Kepong (prefixed *Kep.*) have been fully utilised. One of us (J. W.-S.) spent some time at Kew and at Leiden examining

1. *Penaga* is the well known vernacular tree name for *Mesua ferrea* L.
2. Bintangor is the name under which the timber of *Calophyllum* species is known in and exported from the Malay Peninsula.

some of the older type material, and we are grateful to the authorities there for the facilities afforded him. We are also grateful to Prof. Dr. C. G. G. J. van Steenis at Leiden for supplying copies of various passages from literature not available in Malaya; and to the many members of the Malayan Forest Department who have assisted with collections.

'In Check List' means in Wyatt-Smith's Pocket Check List of Timber Trees, 1952 (Malayan Forest Record No. 17).

Miscellaneous Field Notes

The genus is not difficult to recognise either in the field or in the herbarium owing to the characteristic close and parallel venation of the leaves; the differentiation of the various species, however, is difficult in the herbarium, though very much simpler in the field where bole and bark characters, habitat and colour and nature of exudate, in conjunction with the texture, shape and venation of leaf are often diagnostic. The miscellaneous field notes in the table at the end of this account have therefore been prepared to assist identification in the field and perhaps to provide a quick positive identification from a spot character; they are not complete nor considered in any way to be infallible and should be used only as a ready guide to the species. It is hoped that eventually, when information is more complete, it may be possible to produce a multiple-entry card key from these notes for use in the field.

Key to the Species

The following key is based mainly on vegetative characters of dried specimens and does not claim to do more than give approximate identifications. If used in the field, fallen dried leaves should be examined. The characters used are the average ones for any group. Where there are large variations, the species will be found in more than one section of the key. The numbers refer to the order that the species are described in the text.

A. Adult leaves hairy or rusty tomentose on the undersurface:

B. Leaves softly hairy on undersurface, venation fine and close but usually distinct; exudate clear, golden coloured 5. *C. molle*

BB. Leaves very finely rusty tomentose on undersurface, venation obscure; exudate white .. 6. *C. rubiginosum*

AA. Adult leaves glabrous, or tomentum fugacious and only the midrib below tomentose:

B. Leaf bases cordate, leaves almost sessile:
C. Leaves almost orbicular, to c. 5 cm. long and broad; montane ..... 31. *C. rotundifolium*
CC. Leaves not orbicular, base narrowed and cordate; lowland swamp forest ..... 15. *C. javanicum*
BB. Leaf bases not cordate, leaves petiolate:
C. Bushes or shrubs, not trees:
D. Leaves narrow, lanceolate; riverside bush in Pahang and Kelantan only ..... 41. *C. rupicolum*
DD. Leaves broad, oblong-elliptic or obovate; shrub on rocky seashores ..... 43. *C. biflorum*
CC. Trees:
D.* Mature leaves large, 10 cm. or more long, usually more or less coriaceous, often very coriaceous:
E. Leaf margin very strongly revolute when dry; leaf very coriaceous ..... 22. *C. scriblitifolium*
EE. Leaf margin not or only very slightly revolute:
F. Leaves with a distinct intramarginal vein c. 1 mm. from margin; known only from Malacca 9. *C. griffithii*
FF. No intramarginal vein, the lateral veins running out to thickened margin of leaf or disappearing just before it:
G. Plants of montane or submontane forest, or on ridges, usually at an altitude of 3,000 ft. or more, but sometimes on hilltops lower than this:
H. Leaves rather broad, usually over 5 cm. wide, very stiffly coriaceous, base tending to be rounded, flowers large, 3–3.5 cm. across; recorded only on main range 19. *C. coriaceum*
(N.B. A fruiting collection with a rather broad, over 5 cm. wide, stiffly coriaceous leaf, collected on Gunong Padang, Trengganu at 4,000 ft., has been included doubtfully under *C. tahanense* (4), see below).
HH. Leaves narrower, not very stiffly coriaceous, bases cuneate, flowers where known not so large; not usually on main range:

* [for DD turn to page 295].

J. Venation rather distinct below, midrib slightly and finely raised on upper surface; collected only on G. Belumut and G. Panti ..... 10. *C. sp.*

(N.B. (i) *C. fraseri* (38) very occasionally has leaves of 10 cm. or more in length, but the leaves are only thinly coriaceous and the petiole is about 1 cm. long, compared with 2 cm. or more in *C. sp. No. 10.*

(ii) *C. ferrugineum* var. *neriifolium* (25) has been collected on main range at nearly 2,000 ft., see below).

JJ. Venation not distinct below, midrib obscurely raised on upper surface; collected only on G. Tahan .. 3. *C. tahanense*

(N.B. *C. wallichianum* (2) has been collected at nearly 2,000 ft. on Penang Hill and in Perak, see below).

GG. Lowland forest trees, rarely from over 1,500 ft. altitude; sometimes in swamp forest or in beach forest:

H.* Leaves generally narrowly oblong, usually c. 4–5 cm. wide, but only c. 3 cm. in *C. rupicolum* var. (41) and *C. curtisii* (18):

J. Terminal buds long, narrow, pointed, usually c. 2 cm. or more long:

K. Petioles usually less than 1.5 cm. long, venation on both sides of leaf rather clear cut, upper surface of leaf usually drying reddish brown, inflorescence much longer than petioles, outer sepals pale hoary .... 4. *C. canum*

KK. Petioles usually over 1.5 cm. long, venation on both sides of leaf rather obscure or indistinct, not clear cut, upper surface of leaf usually drying pale brown, inflorescences short, often not much longer than petioles, outer sepals not pale hoary:

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* [for HH turn to page 293].

L. Inflorescence with rather conspicuous bracts at base; exudate usually white (from fresh cuts); bark rather smooth; leaf oblong with very prominent midrib c. 3 mm. wide, glabrous .... 1. *C. incrassatum*

LL. Inflorescence without basal bracts or these small and inconspicuous; exudate usually yellow; bark more or less fissured; leaf elliptic-lanceolate with prominent midrib less than 2 mm. wide, midrib covered with fugacious ferrugineous tomentum 2. *C. wallichianum*

JJ. Terminal buds shorter, usually less than 1.2 cm. long.

K. Apex of leaf blunt, rounded, retuse, or very broadly and bluntly pointed:

L. Leaves elliptic-lanceolate, frequently broadest near base; terminal buds at least 1 cm. long 2. *C. wallichianum*

LL. Leaves oblong, usually widest about middle; terminal buds less than 1 cm. long:

M. Leaves thin textured, inflorescence umbelliform .... 18. *C. curtisii*
(N.B. Leaves of *C. curtisii* only occasionally exceed 10 cm. in length, but when this occurs they appear always to have an acute or acuminate apex, although the typical leaf has a very broad and bluntly pointed apex).

MM. Leaves coriaceous, inflorescence racemose:

N. Inflorescence very short, to c. 2 cm. long, quite glabrous, leaf base often broad and almost rounded, fallen leaf drying rich red-brown; species of peat swamp forest 26. *C. retusum*

NN. Inflorescence longer, to c. 7–8 cm., often more or less tomentose, leaf base always tapered, fallen leaf drying pale brown; species of lowland forest 24. *C. ferrugineum*

KK. Apex of leaf acute or acuminate:

L. Midrib strongly and widely channelled on upper surface for lower (basal) fifth of lamina length 4. *C. canum*

LL. Midrib not or scarcely channelled on upper surface, if channelled very finely so:

M. Leaves broadest towards tip; venation on both surfaces fine, clear and distant, petiole 2–4 cm. long 14. *C. macrocarpum*

MM. Leaves not broadest towards tip, venation obscure and not distant, petiole less than 2 cm. long:

N. Venation incised on lower surface of leaf, petiole c. 5 mm. long . . 41. *C. rupicolum* var.

NN. Venation not incised, petiole 1 cm. or more long:

O. Leaves tending to be broadest near base:

P. Leaves thin textured, venation on lower surface fine, distinct; species of low-lying land and swamp 16. *C. soulattri*

PP. Leaves coriaceous, venation on lower surface obscure; species of lowland and hill forest 2. *C. wallichianum*

OO. Leaves broadest about middle:

P. Venation usually very oblique, side buds usually supra-axillary 17. *C. kunstleri*

PP. Venation not very oblique, side buds axillary:

Q. Leaf coriaceous, frequently reaching 13 cm. long; twigs, except youngest, yellowish and more or less polished
7. *C. flavo-ramulum*

QQ. Leaf thin, rarely reaching 10 cm. long; twigs brownish or greyish
18. *C. curtisii*

HH. Leaves broader: broadly oblong, elliptic, ovate or obovate:

J. Leaves usually markedly acuminate, venation usually oblique:

K. Leaves medium sized, broadest about middle, venation usually very oblique, moderately clear, not distinct, petiole c. 1 cm. long; exudate yellowish, usually clear; lowland forest 17. *C. kunstleri*

KK. Leaves large, broadest towards tip, venation oblique, distant and clear, petiole 2–4 cm. long; exudate yellowish and opaque, riverside tree
14. *C. macrocarpum*

JJ. Leaves not acuminate, venation nearly horizontal:

K. Much branched tree of beach forest only; cultivated elsewhere
11. *C. inophyllum*

KK. Not in beach forest:

L. Inflorescence umbelliform, leaves usually broadest near base
16. *C. soulattri*

LL. Inflorescences racemose (unknown in *C. sp. No. 23*), leaves broadest at or above the middle:

M. Twigs very pale when dry, almost white; venation rather close and clear cut, at least below:

N. Apex of leaf very abruptly and shortly pointed, venation easily visible on both surfaces, petiole over 2 cm. long, terminal buds 1 cm. or more long 23. *C. sp.*

NN. Apex of leaf gradually pointed, venation obscure above, petiole less than 1.5 cm. long, terminal buds 3–4 mm. long 8. *C. tenuivenium*

MM. Twigs dark, or at most yellowish when dry, venation clear or obscure:

N. Leaves with fine, distinct (on upper surface), almost horizontal venation, the veins 1 mm. apart 21. *C. subhorizontale*

NN. Leaves with close, usually obscure venation on upper surface:

O. Leaves elliptic, rather thin 27. *C. floribundum*

OO. Leaves oblong or obovate or oblong-obovate, usually rather stiffly coriaceous:

P. Leaves usually oblong, coriaceous but not stiffly so, without pronounced raised marginal rim:

Q. Leaf base broad and almost rounded, fallen leaves drying rich red-brown, inflorescence very short, to c. 2 cm. long, quite glabrous; species of peat swamp forest 26. *C. retusum*

QQ. Leaf base always tapered, fallen leaves drying pale brown, inflorescence longer, to c. 7–8 cm., often more or less tomentose; species of lowland forest
24. *C. ferrugineum*

PP. Leaves usually oblong-ovate to obovate, stiffly coriaceous, with pronounced raised marginal rim:

Q. Leaves large, to c. 16 cm. x 8 cm., glabrous, base of blade more or less decurrent on petiole, terminal buds usually over 1 cm. long
20. *C. sclerophyllum*

QQ. Leaves medium sized, rarely larger than 10 cm. x 3 cm., often tomentose on midrib below, base of blade not decurrent on petiole, terminal buds under 1 cm. long
12. *C. inophylloide*

DD. Mature leaves smaller, generally considerably under 10 cm. long, coriaceous or thin:

E.* Mountain plants, usually above 3,000 ft., or sometimes on hilltops lower than this:

F. Leaves more or less obovate, tip rounded or retuse, not pointed:

G. Leaves rather narrow, usually less than 2 cm. wide, venation rather obscure, midrib not prominent below; recorded only from Mt. Ophir ..... 30. *C. nodosum*

GG. Leaves broader, usually over 2 cm. wide, venation rather conspicuous, midrib prominent below; not recorded from Mt. Ophir:

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* [for EE turn to page 297].

H. Venation on underside of leaf fine and obscure and without intramarginal nerve; recorded only from Cameron Highlands
34. *C. aureum*

HH. Venation on underside of leaf rather coarse and distinct and with distinct intramarginal nerve; recorded only from G. Padang
36. *C. intramarginale*

FF. Leaves usually more or less elliptic or oblong, not obovate, tip usually more or less pointed, or narrowed and rounded:

G. Petioles short, 5 mm. or less long:

H. Venation on underside of leaf distant and incised, fine and distinct above, leaves usually not less than c. 6 cm. x 2.5 cm., with distinct pale margin; recorded only from G. Belumut and G. Panti
37. *C. blumutense*

HH. Venation on both sides of leaf very close, raised, leaves usually smaller, without distinct pale margin; recorded only from Cameron Highlands .. 33. *C. cuneatum*

GG. Petioles longer:

H. Leaves oblong:

J. Leaves rather broadly oblong, usually over 5 cm. wide, very stiffly coriaceous, base tending to be rounded
19. *C. coriaceum*

JJ. Leaves narrowly oblong, under 4 cm. wide, not stiffly coriaceous:

K. Petiole c. 1 cm. long, fruit more or less oblong, c. 2–2·5 cm. long, pericarp thin; recorded up to 2,000 ft
25. *C. ferrugineum* var. *neriifolium*

KK. Petiole c. 2 cm. long, fruit more or less globose, c. 2 cm. diam., pericarp thick; recorded only from G. Belumut and G. Panti ..... 10. *C. sp.*

HH. Leaves elliptic or lanceolate, not oblong:

J. Leaves thin textured, hardly coriaceous:

K. Margin of leaf pale, petiole c. 5 mm. long, pericarp of fruit thin, brittle; (not a montane species, although found at 3,000 ft. on Kedah Peak)
27. *C. floribundum*

KK. Margin of leaf not pale, petiole slender, c. 1 cm. or more long, pericarp of fruit thick, not brittle
32. *C. symingtonianum*

JJ. Leaves coriaceous or stiffly coriaceous:

K. Leaves lanceolate or ovate-lanceolate, apex acuminate, petiole c. 1 cm. long, venation on underside fairly distinct; recorded mainly from Fraser Hill
38. *C. fraseri*

KK. Leaves nearly always ovate-elliptic, apex not markedly acuminate, petiole c. 7.5 mm. long, venation on underside rather fine and close, not very conspicuous; recorded from G. Benom, G. Tahan, G. Ulu Kechau
35. *C. aureo-brunnescens*

EE. Lowland plants, often in swamp forest or low lying land:

F.* Apex of leaf acute or acuminate, always more or less tapered, leaves not obovate:

G. Midrib of leaf always more or less sunk below, or flat, not raised:

H. Apex of leaf rather long and narrowly acuminate, venation on underside invisible or very obscure, inflorescences c. 2 cm. long, fruit globular, usually less than 1 cm. diam.
29. *C. depressinervosum*

HH. Apex of leaf usually shortly acuminate or acute, venation on underside obscure but fine, inflorescences to c. 6–7 cm. long, fruit ovoid-ellipsoid, c. 2 cm. long
28. *C. pulcherrimum*

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* [for FF turn to page 299].

GG. Midrib of leaf always more or less raised below:

H. Twigs very pale when dry, yellowish or whitish:

J. Leaves narrowly oblong-elliptic, apex with a long narrow acumen, venation on both sides fine and clear cut; exudate yellow 45. *C. sp.*

JJ. Leaves more or less elliptic, apex not narrowly acuminate, venation not clear cut on both sides:

K. Leaves rarely more than 4–6 cm. long, venation indistinct on both sides, petioles 5 mm. long, flowers 1 or 2, rarely 3, in each inflorescence, petals 2; exudate white 42. *C. gracillimum*

KK. Leaves larger, venation rather distinct and clear cut below, petioles over 1 cm. long, inflorescence of 3–4 flowers, petals 0; exudate yellow 8. *C. tenuivenium*

HH. Twigs dark coloured when dry:

J. Leaf bases rounded or very broadly cuneate, twigs, even older ones, persistently tomentose ..... 40. *C. pisiferum*

JJ. Leaf bases tapered, twigs not persistently tomentose:

K. Venation on underside of leaf distant and incised .. 41. *C. rupicolum* var.

KK. Venation on underside of leaf obscure, or clear cut and raised, never distant and incised:

L. Venation sharply cut, raised and distant on both sides of leaf; exudate white ..... 43. *C. biflorum*

LL. Venation close, sometimes obscure, sometimes clear cut on one side or the other; exudate yellow or colourless:

M. Leaves rather stiffly coriaceous, usually long and narrowly acuminate, venation often very oblique, side buds supra-axillary
17. *C. kunstleri*

MM. Leaves thinly coriaceous, not long and narrowly acuminate, venation not very oblique, side buds not supra-axillary:

N. Inflorescence umbelliform, venation on upper surface of leaf rather obscure, often pustulate on under surface, margin of leaf not pale 18. *C. curtisii*

NN. Inflorescences racemiform, venation on upper surface usually clear cut, not pustulate below, margin of leaf pale
27. *C. floribundum*

FF. Apex of leaf rounded, retuse or very abruptly pointed:

G. Leaves broadly ovate, twigs tomentose, often persistently so to slight degree (see also *C. ferrugineum* (24):

H. Leaves thin, c. 6 cm. x 3 cm., base rounded or very broadly cuneate, young twigs and buds lightly tomentose, terminal bud less than 5 mm. long .... 40. *C. pisiferum*

HH. Leaves coriaceous, c. 9 cm. x 4 cm., base broadly cuneate, young twigs and buds densely tomentose, terminal buds c. 1 cm. long .....2. *C. wallichianum* (Renggam and Kluang F.R. collections).

GG. Leaves not broadly ovate, if not larger than c. 6 cm. x 3 cm. then always with tapered base, twigs not persistently tomentose:

H. Midrib on underside of leaf sunk or flat, not raised ..... 28. *C. pulcherrimum*

HH. Midrib of leaf always more or less prominent below:

J. Older twigs pale when dry, yellowish or almost white:

K. Youngest twigs and usually midrib below persistently tomentose, leaves more or less obovate, rigidly coriaceous, inflorescence longer than leaves, outer sepals pale hoary
39. *C. costulatum*

KK. Youngest twigs and midrib below glabrous:

L. Leaves obovate, rigidly coriaceous with almost invisible venation, twigs stout, the youngest ones almost black and strongly angled
46. *C. enervosum*

LL. Leaves thin or coriaceous but not rigidly so, all twigs slender, the youngest ones not strongly angled or black:

M. Leaves thin, small, not obovate, more or less pointed, venation obscure, marginal rim to lamina absent or obscure, inflorescence of 1, 2 or 3 flowers; exudate white .... 42. *C. gracillimum*

MM Leaves coriaceous, always more or less obovate, apex rounded or retuse, strong marginal rim to lamina on upper side, inflorescence unknown; exudate yellow
44. *C. sp.*

JJ. Older twigs dark coloured when dry:

K. Venation on underside of leaf distant and incised 41. *C. rupicolum* var.

KK. Venation on underside of leaves obscure or distinct, but never distant or incised:

L. Leaves more or less obovate, apex rounded or retuse:

M. Leaves usually drying more or less the same colour on both sides, terminal bud usually 5 mm. or more long; exudate yellow-brown
12. *C. inophylloide* and
13. *C. inophylloide* var. *singapurense*

MM. Leaves drying dull dark brown above and warm brown below, terminal bud very small, c. 3 mm. long; exudate yellow
44. *C. sp.*

LL. Leaves not obovate (except in some small-leaved forms of *C. curtisii*):

M. Leaves thin textured, inflorescences umbelliform .... 18. *C. curtisii*

MM. Leaves coriaceous, often stiffly so, inflorescence not umbelliform:

N. Leaves not markedly oblong, venation conspicuous and clear cut on both sides of leaf, inflorescence 2-flowered; exudate white to cream 43. *C. biflorm*

NN. Leaves markedly oblong, venation very fine and close, or obscure, on both sides:

O. Fallen leaves drying a rich red brown, bases broad, often rounded, inflorescence very short (c. 2 cm.) and few flowered; exudate yellowish; species of peat-swamp forest
26. *C. retusum*

OO. Leaves drying pale, bases always tapered, inflorescence usually longer; exudate colourless turning white; species of lowland forest
24. *C. ferrugineum*

1. **Calophyllum incrassatum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 36 m. alta, ramis robustis, cortice nitido, novellis quadrangularis, tenuiter brunneo-tomentosis, gemmis angustis, c. 2·5 cm. ad c. 3·5 cm. longis, tenuiter brunneo-tomentosis. *Folia* coriacea, oblonga vel ovato-oblonga, apice rotundata vel breviter et abrupte acuminata, vel irregulariter emarginata, basi late acuminata vel cuneata, c. 16 cm. × 5·5 cm. ad c. 27 cm. × 7 cm., in costa subtus late prominentia, petiolo 2–3 cm. longo, supra plano. *Racemi* ad c. 3–4 cm. longi, pedunculo brevissimo cum bracteis conspicuis flavo-brunneo-tomentosis instructis, rachidibus flavo-brunneo-tomentosis; *sepala* 4, ovato-oblonga vel late elliptica, exteriora minute puberula, brevissime apiculata, 5·5–6 mm. longa, 5 mm. lata, interiora minora; *petala* 0. *Fructus* plus minusve ellipsoideus vel oblongo-globosus, ad c. 3 cm. longus, minute apiculatus, in sicco rugosus.

A tall *tree*, recorded as up to c. 36 m. in height and 2 m. in girth, without buttresses, bole often nobbly where branches have abscissed, bark smooth, yellow-brown, occasionally grey, cracking slightly, or with shallow obscure fissures 3–5 cm. apart, frequently with abundant small lenticels in vertical lines (in *S.F.N. 30977* light grey, broadly and rather deeply rugose-fissured), outer bark very thin and brittle, inner bark thick, soft, pink to pinkish red, exudate cloudy white turning slightly yellowish on exposure, sometimes clear pale yellow on first exposure, sticky. *Twigs* stout, smooth and somewhat polished, the youngest ones more or less quadrangular, with a fine, brown, mealy tomentum. *Terminal buds* long and narrow, gradually attenuated to apex, c. 2·5–3·5 cm. long, often slightly curved, with the same fine tomentum as on young twigs. *Leaves:* lamina large, coriaceous, slightly hairy along midrib on undersurface of young leaves, more or less oblong, or somewhat ovate-oblong, apex rounded, or very shortly and abruptly acute, or irregularly emarginate with the tip of the midrib projecting as a short mucro, base usually broadly acuminate or cuneate, from c. 12 cm. × 5 cm. to c. 27 cm. × 7 cm., usually c. 16 cm. × 5 cm., sometimes broader in proportion to length, midrib robust and prominent on lower surface, venation variable in prominence but never clearly prominent, usually rather close and faint on both surfaces, petioles 2–3 cm. long, flattened or channelled above.

Inflorescences short, c. 3–4 cm. long, the very short peduncle with rather conspicuous, yellow-brown, mealy bracts, *sepals* 4, obovate-oblong or broadly elliptic, the outer ones 5·5–6 mm. long, 5 mm. wide, very shortly apiculate, tomentose like the inflorescence rachis, the inner ones smaller, *petals* 0, *ovary* globose, or ovoid-globose, c. 2 mm. diam., *style* rather short. *Fruit* oblong-globose or ellipsoid, to c. 3 cm. long, with a very small apiculus,

wrinkled when dry, pale green in life when ripe, pericarp thick, not brittle, turning reddish brown when cut, testa pale brown, faintly wrinkled, very hard, c. 1·5 mm. thick. **Plate II. Fig. 1, A, B.**

TRENGGANU: Bukit Kajang, Kemaman, *Corner s.n.*

PAHANG: Baloh F.R., *Kep. 66644, 66645*; Kuantan, *Kep. 3628, 4183*; Temerloh, *Kep. 5473.*

MALACCA: Bukit Sedanan, *Derry 515*; Selandar Forest, *S.F.N. 2010.*

JOHORE: Banang F.R., *Kep. 45946*; Kluang F.R., *Kep. 69921, 71292, 72705*; Ma'Okil F.R., *Kep. 71279*; Kota Tinggi-Mawai road, *S.F.N. 30977*; Mawai-Jemaluang road, *S.F.N. 34911, Corner s.n. 10-2-35, Corner s.n. 8-2-35*; Jemaluang F.R., *Kep. 69971, 69977, 71889 (?), 73461, 73464*; Renggam F.R., *Kep. 71269.*

SINGAPORE: Sungai Morai, *Ridley 5071*; Mandai road, *Corner s.n.*; Economic Gardens, *Deshmukh s.n.*; Botanic Gardens, *Gardens No. 1962, Kiah s.n.*; Gardens Jungle, *S.F.N. 39452 (?)*; Bukit Timah, *S.F.N. 34647* (TYPE, Holotype in Herb. Singapore), *38846*; MacRitchie Reservoir, *S.F.N. 40226(?).*

A species of lowland forest, sometimes in fresh water swamp forest of the southern half of the Malay Peninsula. It is readily recognised by its large, oblong, coriaceous leaves, and long, slightly curved terminal buds.

We have compared our species with the type of *C. lowei* Pl. from Borneo, which resembles it in leaf characters. It differs, however, in the inflorescence, which in *C. lowei* is larger and more like that of *C. canum.* It is possible that a Forest Department collection from Kuching, Sarawak, *No. 00379*, named *C. lowei* at Kew, is in fact our species.

2. **Calophyllum wallichianum** Planch. & Tri. in Ann. Sci. Nat. Ser. 4, 15 (1861) 277.

A *tree* up to c. 40 m. tall and c. 3 m. in girth, without buttresses, bark greenish grey, fawny-grey or grey-brown, with shallow, distant, irregular fissures, ruggedly angular rugose fissured in large trees, dark dull red under bark, inner bark thick, pinkish red, soft, exudate of white droplets which on exposure turn yellowy-cream coloured, or clear golden-syrup coloured. *Twigs* dark coloured when dry, rather smooth, youngest minutely ferrugineous tomentose, often almost velvety, and frequently with slight glaucous bloom. *Terminal buds* long, narrow, pointed, or rounded at tip, cylindrical or slightly constricted at base c. 1·5–2·5 cm. long, apparently sometimes even longer, minutely reddish tomentose. *Leaves:* lamina glabrous, coriaceous but not thickly so, usually lanceolate or oblong-lanceolate, often widest nearer the base, base rather broadly cuneate, sometimes almost rounded, frequently asymmetric, apex acute or obtuse, from c. 9 cm. × 3 cm. to c. 18 cm. × 5·5 cm., venation rather indistinct on both surfaces,

almost horizontal, slightly more evident above, rather close and irregular and slightly raised, midrib slender above, slightly raised and with a fine median channel towards base, prominent below and rounded, young leaves rufous tomentose on midrib on both sides and on petiole, though tomentum is very fugacious on upper surface of midrib, petiole long, usually over 1·5 cm., reaching c. 3 cm., deep red in life, often dark in dried specimens; fallen leaves frequently folded V-shaped.

Racemes from the upper leaf-axils, often slightly supra-axillary, short, usually not more than c. 3–4 cm. long, more or less ferrugineous tomentose, densely so at base, more sparsely above, *flowers* c. 1·8 cm. across, on pedicels c. 1 cm. long or shorter, *sepals* 4, rufous tomentose externally, *petals* 0 (or ?2–4). *Fruit* nearly globose or oblong-globose or elliptic-obovoid, up to c. 4·5 cm. × 3·5 cm., shortly or obscurely apiculate, green when ripe, turning purple black, when dry dull purplish brown, wrinkled, pericarp thick, not brittle. **Plate III. Fig. 1, C, D.**

TRENGGANU: Bukit Bauk F.R., *Kep. 53362, 67823.*

KEDAH: Perak F.R., *Kep. 59630.*

PENANG: sine loc., *Wallich 4843 p.p.* (TYPE), *Curtis s.n., 1154*; Government Hill, 1,200 ft. and 2,300 ft., *Curtis 1153 p.p.*; Pulau Boetong Reserve, *Curtis 1153 p.p.*; Pantai Acheh F.R., *Kep. s.n. 2-10-47*; Telok Bahang F.R., *Kep. 66368.*

PERAK: Batu Undan F.R., *Kep. 54225*; Kledang Saiong F.R., *Kep. 33634, 65905*; Pulau Lalang (Sembilan Islands), *Kep. 76530*; Segari-Melintang F.R., *Kep. 69412, 69418*; Sg. Pulai, Bukit Bujang Malaka, Kinta, *Kep. 54731*; Tanjong Tualang F.R., *Kep. 63253*; Telok Muroh F.R., *Kep. 76732, 76733.*

JOHORE: Endau-Mersing road, *Kep. 74159, 76299*; Gunong Arong F.R., *70079, 70235*; Gunong Pulai, *S.F.N. 7803*; Jemaluang, *Kep. 73457*; Jemaluang F.R., *Kep. 69969, 69979, 69986, 69989, 72908, 72914, 73458, 73460, 73467, 73553*; Kluang F.R., *Kep. 69919, 76297*; Kota Tinggi road, *S.F.N. 30987*; Mersing, *Kep. 70150*; Panti F.R., *Kep. 63053, 70186, 70351*; Renggam F.R., *Kep. 71265, 71275, 71276, 71295*; Mawai-Jemaluang road, *Corner s.n., 5-5-35.*

SINGAPORE: Bukit Timah, *Ridley 6333, Corner s.n., S.F.N. 33561, 34546, 34632, 36476, Kep. 70531*; Bukit Mandai, *Mat. s.n.*; Gardens Jungle, *S.F.N. 39451.*

King in the Materials and Ridley in Flora of the Malay Peninsula misinterpreted this species and what they put under it we have redescribed as *C. rubiginosum.* The type is the part of *Wallich 4843* preserved in Herb. de Candolle, which is given by the authors in the original description as from 'Penang et Singapore'.

C. wallichianum is said in the original description to have 'petalis 2 (v. 3–4?)', but in the material available to us for dissection no petals have been found. A copy of a note by King on a sheet of *Curtis 1153* states that there are no petals.

This species is characterised by the coriaceous, oblong leaves with a tendency in the north-western collections to be broadest near the base, the indistinct venation, the long dark petiole and rather dark (often with a tinge of purple) midrib, the long terminal bud and the frequently supra-axillary side buds. It is a common species of coastal hill forest, frequently on ridge tops, and has been collected at an elevation of over 2,000 ft. on Penang island and at 1,750 ft., in Perak. The collections show a distinct broken distribution, none occurring from Selangor, Negri Sembilan and Malacca, but one of the authors (J. W.-S.) has seen this species in the field in Bukit Lagong F.R., Selangor, at an elevation of about 1,000 ft.

We originally decided to separate off the southern collections (Trengganu, Pahang, Johore, Singapore) and in fact described them in manuscript as a new species, *C. rufigemmatum*. Subsequent collections did not support this, though in general the north-western form has a milky white exudate which turns slightly yellow on exposure, a broader leaf usually widest nearer the base, sparsely ferrugineous tomentose bud and young twigs, and a more pointed, frequently curved, bud compared with the southern and eastern form, which has a clear, golden-syrup coloured exudate, an oblong lanceolate leaf, a more ferruginous tomentose bud and young twigs, and a blunt, cylindrical, straight bud.

All the collections in Renggam and Kluang Forest Reserves, both adjoining reserves in central Johore, have slightly more coriaceous leaves with a wider lamina in proportion to length than in typical leaves, a dense velvety ferruginous tomentum on the young twigs, petioles, midribs and buds, and a very cylindrical bud. These may represent a distinct species, but in the absence of fertile material they are included in *C. wallichianum* for the present, as bark and slash characters are typical of the southern form.

The species described in the Check List as *C. wallichianum* is in fact *C. rubiginosum*.

3. **Calophyllum tahanense** Henderson & Wyatt-Smith, **sp. nov.**

Arbor c. 10 m. alta, ramis in sicco flavis, cortice nitido, novellis flavo-bruneo-tomentosis, gemmis angustis, tenuiter ferrugineo-tomentosis, c. 1–3 cm. longis. *Folia* coriacea, oblongo-lanceolata vel anguste oblonga, ad c. 21 cm. longa et 4 cm. lata, saepe latiora brevioraque, apice obtuse acuta, basi cuneata, nervis lateralibus plus minusve obscuris, vix prominulis, petiolo c. 2·5–4 cm. longo. *Racemi* ad c. 7 cm. longi, saepe paniculati-approximati, rachide pedicellisque leviter ferrugineo-tomentosis, pedicellis gracilibus, ad c. 2 cm. longis; *sepala* 4, oblongo-ovata, concava, extus minute puberula, exteriora c. 6 mm. × 5 mm., interiora c. 3·5 mm. × 2·5 mm., *petala* 2 vel 0, glabra. *Fructus* c. 3 cm. longus et 2·5 cm. latus, umbonatus.

A *tree* about 10 m. tall, with slightly rough, thin bark with vertical, rusty-brown, slender, cracking lenticels. *Twigs* tending to be yellowish and polished, young twigs and shoots with dusty, yellow brown tomentum. *Terminal buds* narrow and pointed, c. 1–3 cm. long, very finely reddish tomentose. *Leaves* coriaceous, glabrous, oblong lanceolate to narrowly oblong, apex bluntly acute, base cuneate, up to c. 21 cm. × 4 cm., often wider and shorter, petiole long, usually 2·5–4 cm., black when dry, venation below rather faint and not prominent, rather variable but always close and rather obscure, similar on the upper surface.

Inflorescences racemiform or paniculiform, somewhat pyramidal in outline, up to c. 7 cm. long, rachis and pedicels finely rusty tomentose, pedicels slender, variable in length, but not exceeding c. 2 cm., *sepals* 4, oblong ovate, concave, finely tomentose outside, closely longitudinally veined, outer ones c. 6 mm. × 5 mm. when flattened, inner ones c. 3·5 mm. × 2·5 mm., *petals* 2, thinner than the sepals and glabrous, not always present, *stamen filaments* c. 4–4·5 mm. long, *style* long, stout, stigma rather large. *Fruit* broadly ellipsoid or more or less globose, with an abrupt beak which is sometimes very conspicuous, c. 3 cm. long and 2·5 cm. diam., pericarp thick, not brittle, glabrous, probably smooth in life, drying dark reddish brown, finely and shallowly wrinkled, surface smooth between wrinkles, testa thick and hard. **Plate IV. Fig. 2, A, B.**

TRENGGANU: Gunong Padang, 4,000 ft., *S.F.N. 31076*. (This collection is placed here with some doubt. It consists of leaves and full grown fruit. The leaves are broader than in the type, with a more rounded base and a flatter and broader midrib below, which is channelled above; the fruit is about the same shape and size, with a small umbo. The exudate is stated to be white).

PAHANG: Base of Gunong Tahan, in the vicinity of Wray's Camp, c. 3,500 ft., *Wray & Robinson 5344, S.F.N. 8020, 20601* (TYPE, Holotype in Herb. Singapore), *Corner s.n. 11-9-37*.

Our species is close to *C. wallichianum* Pl. & Tr.

4. **Calophyllum canum** Hook. f., F.B.I. 1 (1874) 271; King, Mat. F.M.P. No. 2 (1890) 177; Ridl., F.M.P. 1 (1922) 185, *p.p.*

A *tree* recorded as reaching c. 35 m. tall and over 2m. in girth, without buttresses, bark yellow-brown and brown to grey, smooth with lenticellate-cracking or boat-shaped fissures when young, becoming rough and coarsely distantly fissured, exudate clear yellow brown, sticky. *Twigs* rather smooth, glabrous except for the youngest, which are finely and thinly rusty tomentose. *Terminal buds* long and narrow, c. 1·2 cm. long, very finely rusty hoary, with a tendency to be abruptly narrowed half way. *Leaves:* lamina rather thin, oblong to elliptic-oblong, usually acute at tip and

base, variable in size, from c. 10 cm. × 3·5 cm. to c. 18 cm. × 5–6 cm., upper surface dark and shining when dry, venation fine, close, usually fairly distinct on both surfaces, midrib channelled above, especially towards petiole, petiole usually 1–1·5 cm. long, black when dry; fallen leaves with shiny red-brown upper surface.

Racemes from the upper axils and sub-panicled terminally, rather copious, hoary, *flowers* shortly pedicellate, c. 1·5 cm. across, *sepals* 4, the two outer ones orbicular, hoary at least when young and in bud, inner ones larger and thinner, petals 0. *Fruit* broadly ellipsoid to globose, apex rounded, c. 2–2·5 cm. long, pericarp rather thick, said to be white in life, when dry reddish brown to blackish brown, glabrous, surface rather coarsely wrinkled, smooth between wrinkles. **Fig. 2, C, D.**

PENANG: Road to Spout, 800 ft., *Curtis 1543*; Government Hill, 1,000 ft., *Curtis 1543*; Government Hill, *Curtis 1153 p.p*; Waterfall Gardens, *S.F.N. 3695*, *Nur s.n.*

PERAK: sine loc., *Scortechini 2044*, *2078*; Larut, within 100 ft., *Kunstler 5420*; Larut, 800–1,000 ft., *Kunstler 7704*; Batu Gajah, *Kep. s.n. Feb. 1918*; Pondok Tanjong F.R., *63467 (?)*; Tanjong Tualang F.R., *Kep. 65711.*

SELANGOR: Rantau Panjang F.R., *Kep. 28918*; Weld Hill F.R., *Kep. 72436.*

MALACCA: sine loc., *Maingay 1645* (TYPE); Batang Malaka, *Goodenough 1791.*

NEGRI SEMBILAN: Senawang F.R., *Kep. 609.*

PAHANG: Pekan, *Haviland s.n.*; Kuantan, *Kep. 0883*, *43188*; Temerloh, *Kep. 5464*; Gunong Lesong F.R., *Kep. 10013.*

JOHORE: Banang F.R., *Kep. 80557*; Ma'Okil F.R., *Kep. 71284*; Sungai Sedili, *S.F.N. 36891.*

A widely distributed and locally common (e.g. Baloh F.R.) species of lowland forest, distinct in the medium-sized, hardly coriaceous leaves shining above and dark red brown in colour when dry, with fine and more or less distinct venation, and in the rather copious inflorescences with finely hoary outer sepals. It is close to *C. wallichianum* Pl. & Tri., but differs from that species in having much clearer cut venation, especially on the undersurface of the leaf, the leaves drying darker above, and in the longer and more compact inflorescences with pale hoary outer sepals.

In Check List as '*C. canum* H.f.'.

5. **Calophyllum molle** King, Mat. F.M.P. No. 2 (1890) 177; Ridl., F.M.P. 1 (1922) 185.

A *tree* up to c. 26 m. tall and c. 1 m. in girth, bark pale grey, closely and very finely lenticellate-fissured, almost smooth, cut pink, exudate clear golden coloured. *Twigs* terete, pale, smooth, the youngest ones softly ferrugineous tomentose and pale yellowy

grey when tomentum removed. *Terminal buds* rather narrowly oblong-ovate, usually a little under 1 cm. long, densely ferrugineous tomentose. *Leaves:* lamina rather thinly coriaceous, narrowly oblong to narrowly oblong-elliptic, leaf margin frequently strongly thickened, apex bluntly pointed, base narrowed and rounded, or cuneate, slightly cupped on undersurface, c. 8 cm. × 2 cm. to c. 11 cm. × 4 cm., undersurface usually always more or less ferrugineous tomentose, the oldest leaves becoming glabrous except for the midrib below which is always softly tomentose, venation on upper surface close, fine, sharply cut, obscured below by tomentum, but less sharply cut, petiole c. 5–10 mm. long.

Racemes axillary, few-flowered, c. 2·5 cm. long, rachis red tomentose, pedicels tomentose, *flowers* c. 1·5 cm. across, *sepals* 4, the two outer rather thick, oblong-orbicular, c. 8 mm. × 6 mm., closely tomentose outside, the inner ones larger and thinner, only slightly tomentose externally at base and on margins, *petals* 0, *ovary* tomentose, *style* short. *Fruit* globose-ellipsoid, c. 2·5 cm. long, sparsely reddish tomentose, dark green turning brown in life, usually shortly and abruptly apiculate, but sometimes apiculus obscure, pericarp thick, not brittle, drying somewhat glaucous reddish brown, with shallow distinct wrinkles, smooth between wrinkles, testa thick and hard.

PENANG: sine loc., *Kep. 40466*; Penang Hill, up to c. 2,000 ft., *Curtis 1426* (TYPE).

PERAK: Larut, *Kunstler 3477, 3737, 6724, Scortechini s.n., Kep. 20*; Tapah Road, *Kep. 4563*; Ulu Piah, *Kep. 11970*; Tronoh, *Kep. 12022*; Tanjong Tualang F.R., *Kep. 63272*.

SELANGOR: Kanching F.R., *Kep. 21975*; Kuang F.R., *Kep. 14774, 14775, 14776, 14777*; Rantau Panjang F.R., *Kep. 24931*; Bukit Lagong F.R., *Kep. 52233*.

PAHANG: Temerloh, *Kep. 5458, 6305*; Bilut F.R., *Kep. 23353*.

A collection from swampy forest at Mandai, Singapore, *S.F.N. 37715*, may belong here, although it differs somewhat in having rather more prominent venation below, the base of the leaf more narrowly cuneate and in the small, pea-shaped fruit which, however, is seedless. At the same time, *C. molle* is not normally found in swamp forest and there are no collections from Johore.

The species is one of lowland forest; it is distinct because of the persistent, soft tomentum on the undersurface of the leaves, the short inflorescences and hoary outer sepals.

6. **Calophyllum rubiginosum** Henderson & Wyatt-Smith, **sp. nov.**

Calophyllum wallichianum sensu King, Mat. F.M.P. No. 2 (1890) 179., quoad descript.; et Ridley, F.M.P. 1 (1922) 187., pro parte, non Planch. & Triana.

Arbor ad c. 35 m. alta, ramulis in sicco flavis vel fere albis, cortice nitido, novellis tenuiter ferrugineo-tomentosis, gemmis rubro-tomentosis, angustis, apice abrupte acutis, c. 6–12 mm. longis. *Folia* subcoriacea, plus minusve elliptico-oblonga, apice acuta, nonnunquam acuminata, basi cuneata, c. 8 cm. × 3 cm. ad c. 18 cm. × 5 cm., subtus minute sed dense rufo-tomentosa, nervis lateralibus obscuris tenuissimis, petiolo ad c. 3 cm. longae, gracile. *Racemi* terminales et axillares, ad c. 9 cm. longi, ferrugineo-tomentosi, pedicellis brevibus; *flores* c. 1·2 cm. diam.; *sepala* 4, orbicularia, ferrugineo-tomentosa; *petala* 4, plus minusve oblonga. *Fructus* ovoideo-ellipsoideus, c. 2·5 cm. longus, rostratus.

A *tree,* recorded as reaching c. 35 m. tall and 1·5 m. in girth, but usually not so tall or large, without buttresses, bark grey and yellowish green, smooth to rough, very finely fissured, inner bark pinkish, exudate white, copious. *Twigs* pale, smooth, yellowish to almost white, the youngest ones finely rusty tomentose. *Terminal buds* narrow, rather abruptly and sharply pointed, red tomentose, c. 6–12 mm. long. *Leaves:* lamina medium-sized, subcoriaceous, more or less elliptic-oblong, apex acute, sometimes acuminate, base cuneate or rather gradually narrowed, from c. 8 cm. × 3 cm. to c. 18 cm. × 5 cm., upper surface glabrous, lower surface finely rusty tomentose, venation on the upper surface hardly visible, very fine and often incised, obscured on the lower surface by the tomentum, but when this is removed, very fine and inconspicuous, very slightly raised, not sharply cut, usually with a slightly more marked vein at intervals of 3–4 mm., petiole variable, reaching c. 3 cm. long, rather slender.

Racemes axillary and terminal, reaching more than half the length of the leaves, usually somewhat shorter, rusty tomentose, pedicels usually short, *flowers* c. 1·2 cm. diam., *sepals* 4, orbicular, rusty tomentose on both sides, *petals* 4, more or less oblong. *Fruit* ovoid-ellipsoid, beaked, c. 2·5 cm. long, pericarp rather thick, not brittle, pale reddish brown when dry, deeply wrinkled, the surface crackled and scabby. **Plate V. Fig. 2, G, Fig. 3, A.**

SELANGOR: Kepong, *Kep. 38507, 38512, 39900*; Sungei Lalang F.R., *Kep. 53604*; Bukit Tunggal F.R., *Kep. 23664*; Bangi F.R., *Kep. 0312, 0557, 2583, 2623, 10974, 14579, 26454, 26455*; Weld Hill F.R., *Kep. 0338, 2615*; Sungei Buloh F.R., *Kep. 1592, 5314, 14904, 15258, 16441, 16462, 16872, 76371*, Jalan Rajah, Kuala Lumpur, *Kep. 10470*; Public Gardens, Kuala Lumpur, *Kep. 4740*; Bukit Cheraka F.R., *Kep. 18702, 65567*; Kuang F.R., *Kep. 21958, 21962, 21988, 21992*; Ulu Gombak F.R., *Kep. 11645*; Kajang, *Kep. 2649*; Ayer Hitam F.R., *Kep. 10903*; Rantau Panjang F.R., *Kep. 14768, 14769, 14770, 14771, 14772, 32204*; Kanching F.R., *Kep. 13958, 14782, 21259.*

MALACCA: Sungai Udang, *Holmberg 819*; Batang Malaka F.R., *Kep. 2063*; Ayer Panas F.R., *Kep. 25211, 25253*; Ramuan China F.R., *Kep. 25257*; Bukit Sedanan F.R., *Kep. 25271, 25322.*

NEGRI SEMBILAN: Gunong Angsi F.R., *Kep. 1953* (TYPE, Holotype in Herb. Kepong), *23713*; Sungai Menyala F.R., *Kep. 43665, 64654*; Senawang F.R., *Kep. 18505.*

JOHORE: Sungei Kayu, *Kiah s.n.*; Jemaluang F.R., *Kep. 69995.*

SINGAPORE: Bukit Timah, *Ridley 6196, S.F.N. 36449, Mat. s.n.*; Chua Chu Kang, *Ridley s.n.*; Botanic Gardens, *Nur 1668, s.n.*

This species, which was misinterpreted both by King and by Ridley, is common in lowland forest from Selangor southwards. It is very distinctive in its pale yellow twigs and in the fine covering of rusty tomentum on the young twigs, undersides of the leaves and on the inflorescence.

In Check List as '*C. wallichianum* Pl. & Tri.'.

7. **Calophyllum flavo-ramulum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 36–38 m. alta, ramulis robustis, teretibus, cortice nitido, pallide flavo ad fere albo, junioribus angulosis, plus minusve rufo-tomentosis, gemmis brevibus, acutis, rufo-tomentosis, c. 5 mm. longis. *Folia* coriacea, oblonga, nonnunquam anguste oblonga, vel plus minusve oblongo-elliptica vel oblongo-lanceolata, apice plus minusve acuminata, nonnunquam abrupte acuta, basi cuneata, c. 10 cm. × 3 cm. ad c. 14 cm. × 5 cm., nervis lateralibus utrinque tenuissimis, approximatis, leviter prominulis sed non conspicuis, petiolo ad c. 1·5 cm. longo. *Racemi* axillares, pyramidiformi, ad c. 9 cm. longi, pedicellis decussatis, gracilibus; *flores* c. 2 cm. lati; *sepala* exteriora parva, ovato-orbicularia, concava, c. 5·5 mm. × 5 mm., extus plus minusve minute ferrugineo-tomentosa, interiora tenuiora, maiora, plus minusve elliptica, c. 10 mm. × 7 mm., *petala* 4, sepala interiora similiter, interiora anguste obovata, c. 11 mm. longa, exteriora latiora, breviora. *Fructus* globosus vel ellipsoideus, c. 2 cm. longus.

A tall, top storey *tree*, reaching c. 36–38 m. tall, and c. 2 m. girth at breast height, without buttresses, bark greeny-grey and yellowish fawn with shallow or deep (large trees), distant, irregular fissures and anastomosing ridges, rough and flaky, inner bark pale pink to pinky red, laminated, exudate clear, honey coloured or yellow brown, very sticky. *Twigs* rather stout, terete, polished, pale yellow to almost white, youngest shoots dark coloured, angular, more or less red tomentose. *Terminal buds* short, sharply pointed, red tomentose, c. 5 mm. long. *Leaves:* lamina medium-sized, coriaceous, upper surface glossy, lower surface dull, oblong, sometimes narrowly so, or more or less oblong-elliptic or oblong-lanceolate, apex usually more or less acuminate, sometimes abruptly so, sometimes rather abruptly acute, base cuneate, usually from c. 10 cm. × 3 cm. to c. 14 cm. × 5 cm., sometimes wider or narrower in proportion, venation on both sides very fine, close, slightly raised but not conspicuous, midrib narrowly channelled above in the basal half of the leaf, prominent below, with fine red tomentum along midrib particularly in young leaves, petiole rather slender to rather stout, to c. 1·5 cm. long.

Racemes axillary, usually 1 but occasionally 2 from each leaf axil, up to c. 9 cm. long, pyramidal, with c. 5 decussate pairs of flowers and a terminal one, the lowermost branches sometimes 2–3-flowered, peduncle, rachis and pedicels white, slightly rusty pubescent when dry, *flowers* c. 2 cm. across, *sepals* 4, the outer two comparatively small, not very thick, reflexed in the open flower, ovate-orbicular, concave, c. 5·5 mm. × 5 mm., finely rusty tomentose outside but variable in this respect and sometimes almost glabrous, inner sepals larger, thinner, more or less elliptic, rounded, c. 10 mm. × 7 mm., *petals* 4, similar to the inner sepals, the 2 inner ones narrowly obovate, c. 11 mm. long, the 2 outer ones broader and shorter. *Fruit* broadly ellipsoid to globular, subacute, c. 2 cm. long, pericarp rather thick, slightly brittle but not breaking up in dried material, dark reddish to blackish brown when dry, glabrous, minutely rugulose or almost smooth, testa thick and hard. **Plate VI. Fig. 3, B, C.**

TRENGGANU: Bukit Kajang, Kemaman, *S.F.N. 30321* (TYPE, Holotype in Herb. Singapore); *30565, Corner s.n.*; Dungun, *Kep. 53353 (?)*; Belara F.R., *Kep. 76064.*

PAHANG: Kuantan, *Kep. 4198*; Baloh F.R., *Kep. 40216.*

JOHORE: Kluang F.R., *Kep. 69920, 71289*; Jemaluang F.R., *Kep. 73552.*

A rather distinct large species of lowland forest and low hills in eastern Malaya, widespread but little collected, resembling superficially *C. canum* but with very pale yellow twigs and different flowers. The fallen leaf has a dark midrib and raised lamina edges (boat-shaped).

In Check List as '*C. sp.* No. 36'.

8. **Calophyllum tenuivenium** Henderson & Wyatt-Smith, **sp. nov.**

Arbor c. 20 m. alta, ramis in sicco glabris, cortice nitido, flavo-albis, gemmis parvis, angustis, acutis, minute ferrugineo-tomentosis, c. 3–4 mm. longis. *Folia* glabra, tenuiter coriacea, elliptica, apice breve et late acuta, basi cuneata, c. 7 cm. × 3 cm. ad c. 10 cm. × 4·5 cm., nervis lateralibus subtus conspicuis sed tenuissimis, inter se distantibus, supra obscuris, petiolo 1–2 cm. longo. *Racemi* axillares et terminales, ad c. 4 cm. longi, pedunculo ad c. 1 cm. longo, pedicellis ad c. 3 cm. longis; *flores* albi, c. 2 cm. lati; *sepala* 4, exteriora glabra, concava, c. 6 mm. longa, interiora maiora, tenuiora, late ovato, c. 1 cm. longa, basi 1 cm. lata; *petala* 0. *Fructus* ignotus.

A *tree* c. 20 m. tall, without buttresses or stilt roots, bark yellowish grey, slightly fissured, inner bark pinkish brown, fibrous, exudate yellow, rather scanty. *Twigs* rather stout, pale, the youngest ones pale yellowish white, glabrous, slightly polished, the older ones slightly darker. *Terminal buds* small, narrow, pointed, c. 3–4 mm. long, minutely adpressed brown or reddish brown hairy. *Leaves:* lamina glabrous, thinly coriaceous, medium-sized, elliptic, apex usually shortly and broadly acute, base cuneate, from c.

7 cm. × 3 cm. to c. 10 cm. × 4·5 cm., upper surface drying dull brown, lower surface more reddish brown, midrib slender and raised above, usually finely channelled near base, rather prominent below and more or less keeled, venation very fine, raised, rather clear cut below, rather distant (c. 7 veins to 5 mm.), very fine and hardly raised above, often obscure, leaf margin with an inconspicuous, narrow, slightly thickened edge darker in colour than rest of leaf, petiole usually 1–2 cm. long.

Racemes short and few-flowered, from the upper or terminal leaf-axils, 4 cm. long or less, peduncles variable in length from almost none to c. 1 cm. long, 3–5-flowered, pedicels slender, white in life, to c. 3 cm. long, *flowers* rather large, c. 2 cm. across, fragrant, *sepals* 4, white, the two outer glabrous, boat-shaped and very concave, spreading horizontally in the open flower, c. 6 mm. long, the inner ones thinner, larger, broadly ovate, rounded, c. 1 cm. long and 1 cm. broad at base, reflexed in open flower, veined, *petals* 0, stamen filaments pale yellow, anthers golden yellow, *ovary* white. *Fruit* unknown. **Plate VII. Fig. 3, D.**

JOHORE: 8th mile, Kota Tinggi-Mawai road, in fresh water swamp forest, *S.F.N. 32274* (TYPE, Holotype in Herb. Singapore).

Known only from the above collection. The elliptic, rather thin leaves, with very fine clear cut and rather distant venation on the lower surface, the pale, more or less polished twigs and the rather large flowers in short inflorescences distinguish this species. It is close to *C. rupicolum* var. but the lamina is broader, the venation is distinct and the petiole is longer.

9. **Calophyllum griffithii** T. Anders. in Hook. f., F.B.I. 1 (1874) 273; King, Mat. F.M.P. No. 2 (1890) 179; Ridl., F.M.P. 1 (1922) 187, as to Griffithian specimen only.

A *tree*. *Twigs* rather stout, glabrous, the youngest ones pale brown when dry and 4-angled, the older ones terete and darker brown. *Terminal buds* short, pyramidal, adpressed pale brown hairy, c. 3 mm. long. *Leaves* thinly coriaceous, glabrous, oblong or elliptic-oblong, apex obtuse or broadly and shortly acute, base cuneate, up to c. 14 cm. × 5 cm., upper surface shining and leaden brown when dry, lower surface reddish brown, midrib narrow and raised above, narrowly channelled at base, prominent below, pale, rounded or slightly keeled, venation fine and clear cut, equally raised on both surfaces, rather distant (about 5 veins in 4 mm.), anastomosing in a distinct intra-marginal vein c. 1 mm. from leaf margin, this vein rather more easily visible on the upper surface than the lower, leaf margin slightly thickened and pale, petiole to c. 1·5 cm. long.

Racemes axillary, few-flowered, reaching c. 6 cm. long, glabrous pedicels very variable in length, slender, reaching c. 1·5 cm., with a tiny, deciduous bract at the base of each, *flowers* c. 1 cm. across, *sepals* 4, the outer two glabrous, orbicular, eventually reflexed, inner two longer and narrower, *petals* 4, oblong, rounded. *Fruit* not seen.

MALACCA: Ching, *Griffith 882* (TYPE).

No other material of this species has been seen from Malaya. King adds *Forbes 322a* from Sumatra, which we have not seen.

This and *Calophyllum intramarginale* nob. are the only Malayan species, to our knowledge, which have a distinct intramarginal nerve with which the lateral veins anastomose. In all other species the veins run out to a usually thickened leaf margin (which *C. griffithii* also has), or disappear before they reach the margin.

10. **Calophyllum sp.**

A *tree*, apparently rather large, reaching c. 20 m. tall. *Twigs* stout, older ones terete, youngest ones 4-angled, dark brown or yellowish brown, tending to be polished. *Terminal buds* stout, lanceolate acute, finely tomentose, c. 1·5 cm. long. *Leaves* very coriaceous, rather narrowly oblong-elliptic or oblong or narrowly ovate-elliptic, apex apparently rounded, usually irregularly emarginate with the tip of the midrib projecting (?due to injury), base narrowly and rather long cuneate, from c. 7 cm. × 3 cm. to c. 14 cm. × 4·5 cm., drying brown or dark brown, upper surface usually darker than lower and more or less shining, venation close and fairly distinct, raised on both surfaces, more distinct on the upper surface, midrib narrowly channelled in the basal half above, rounded and prominent below, petiole rather long and slender, c. 2–2·5 cm. long.

Flowers unknown, inflorescence probably short, axillary, having short, stout branches in fruit, *fruit* broadly ellipsoid to almost globose, slightly pointed, green when ripe, c. 2·5 cm. long, pericarp very thick, not brittle, drying dark reddish brown, glabrous, surface very shallowly and finely wrinkled, testa thick, hard. **Plate VIII. Fig. 3, E.**

JOHORE: Gunong Belumut, 3,000 ft., *S.F.N. 10723*; Gunong Panti, 1,600 ft., *S.F.N. 29969*.

Known only from these two collections, which we have been unable to match. This group appears to be near *C. canum* but has much more coriaceous leaves (in which it resembles *C. incrassatum*) and stouter twigs and terminal buds. It resembles in some respects *C. tahanense*, but the midrib in the latter species is not raised on the upper surface, and it may be the southern counterpart of it.

11. **Calophyllum inophyllum** Linn., Sp. Pl. 732; King, Mat. F.M.P. No. 2 (1890) 178; Ridl., F.M.P. 1 (1922) 186.

A large, spreading *tree*, usually not reaching a height greater than 20 m. and a girth of 1·5 m., usually branching low down, without buttresses, bark pale grey and fawn, with shallow, wide, lenticellate-cracking boat-shaped fissures, brown at bottom of cracks, inner bark soft, pink, laminated, exudate clear golden yellow. *Twigs* stout, dark coloured when dry, glabrous. *Terminal buds* nearly triangular, finely brown tomentose, c. 5–10 mm. long. *Leaves:* lamina thinly coriaceous, broadly elliptic-oblong, often broadest a little above the middle, apex rounded, or widely and shallowly emarginate, base narrowed, variable in size, from c. 8 cm. × 4·5 cm. to c. 16 cm. × 8 cm., but sometimes smaller or larger, venation distinct, raised and clear cut on both surfaces when dry, petiole rather stout, rather short, broadened at apex, 1–1·5 cm. long.

Racemes from the upper leaf-axils, 7–8 cm. long, rachis almost white in life, laxly flowered, pedicels spreading-ascending, white, the lower ones c. 3 cm. long, the upper ones shorter, *flowers* c. 2 cm. across, sepals and petals white, *sepals* 4, reflexed in open flower, the outer two tough in texture, c. 9 mm. long, the inner ones thinner and longer, petaloid, *petals* 4, reflexed in open flower, similar to inner sepals, *ovary* pink, somewhat depressed globose, *style* slender, overtopping the stamens. *Fruit* globose, smooth and green in life, c. 3–4 cm. diam., pericarp thick, not brittle, when dry rather pale brown, coarsely wrinkled, surface smooth between wrinkles. **Fig. 4, A, B.**

KEDAH: Pulau Songsong, *Curtis s.n.*; Kuah, Langkawi, *Kep. 6789*; Tanjong Lilin, *Kep. 7730*; Kg. Telok, *Kep. 33001*; Baling, *Kep. 10097, 42270.*

PENANG: Batu Ferenghi, *Curtis 133, 1562.*

PERAK: sine loc., *Scortechini s.n.*; Pangkor, *Scortechini 994, Kep. 43589*; Larut, *Kunstler 4979*; Bagan Serai, Krian, *Kep. 5680*; Pulau Lalang, *Seimund s.n.*; Pulau Rumbia, *Seimund s.n.*; Pasir Itam, Matang, *Kep. 3426.*

SELANGOR: Weld Hill F.R., *Kep. 904* (?planted).

NEGRI SEMBILAN: Port Dickson, *Kep. 0569.*

PAHANG: on seashore, *Ridley s.n.*; Kuantan, *Kep. 0821, 1014, 2591, 2810, 3705, 3737, 4179*; S. Karang, Kuantan, *Kep. 8116, 8132, 15734, 17357*; Kuala Pontian, *Kep. 10016*; Kuala Endau, *Kep. 29645*; Rompin, *Kep. 31651*; Pulau Tioman, *Burkill s.n., S.F.N. 18530.*

SINGAPORE: Bajau, *Ridley s.n.*; sine loc., *Cantley 2676.*

A widely distributed tree of rocky and sandy seashores, often cultivated. It is commonly known by the vernacular name of *penaga laut.*

In Check List as '*C. inophyllum* L.'.

12. **Calophyllum inophylloide** King, Mat. F.M.P. No. 2 (1890) 178; Ridl., F.M.P. 1 (1922) 186, *p.p.*

A *tree* reaching c. 42–43 m. tall and over 2 m. in girth, without buttresses, or with very small buttresses, stilt roots frequently present, bark grey-brown to dull brown or greyish fawn, roughly shallowly fissured, c. 3 cm. between fissures, more or less scaling, sometimes with pale yellow-fawn or brick red patches where dead bark has scaled off, inner bark pink, laminated, exudate clear lemon yellow and resinous, sapwood hard, pinkish red. *Twigs* dark coloured, stout, almost glabrous, the youngest usually very finely rusty tomentose. *Terminal buds* rather narrow, 6–10 mm. long, more or less tomentose. Lamina of mature *leaves* usually medium-sized, coriaceous to strongly coriaceous, nearly always more or less obovate, usually from c. 7 cm. × 3·5 cm. to c. 10 cm. × 5 cm., apex usually retuse, gradually narrowed from about the middle to base, margin markedly thickened, venation very close and fine, not conspicuous, usually a little more evident above than below, sometimes rather obscure, petiole usually rather stout, variable in length, reaching c. 2 cm.

Inflorescenes from the axils of the upper leaves, racemose or the lower ones subpaniculate, rather slender and laxly flowered, to c. 6 cm. long, glabrous except at base of peduncle, which is finely mealy tomentose, pedicels slender, to c. 2 cm. long, *flowers* glabrous, c. 1·75–2 cm. across, *sepals* 4, the outer ones rather tough, ovate-orbicular, c. 5–8 mm. diam., reflexed in expanded flower, as are the inner sepals and petals, inner sepals longer and thinner than the outer ones, *petals* similar to inner sepals or 0, *stamen* filaments short, *ovary* broadly conical. Young *fruit* ovoid-globose, c. 2 cm. long, in life dark green mottled with light grey, pericarp not wrinkled when dry. **Fig. 4, C.**

TRENGGANU: Belara F. R., *Kep. 76055, 76066.**

PENANG: Tasek Glugor F.R., *Kep. 9839* (a little doubtful); Telok Bahang F.R., *Kep. 66369.**

PERAK: sine loc., *Scortechini s.n.*; Batang Padang, *Kunstler 7785, 8112*; Taiping, *Kep. 0273*; Tapah, *Kep. (Ridley) 384*;* Chikus F.R., *Kep. 3071, 31043, 51575, 65053*, Pondok Tanjong, *Kep. 37883, 65558*; Parit F.R., *Kep. 39464*; Bruas F.R., *Kep. 69406*; Sungai Gelam, Dindings, *Kep. 69429.*

SELANGOR: Bukit Lagong F.R., *Kep. 13281*;* Ulu Gombak, *Kep. 24703*;* Ginting Simpah, *Kep. 71248.**

NEGRI SEMBILAN: Sertang F.R. (Ext.), *Kep. 62956*,* *62957.**

JOHORE: Kluang F.R., *Kep. 76290.**

King does not quote the numbers of his type specimens in the Materials, but we have taken as authentic those sheets in Herb. Calcutta written up by him.

(* Hill collections with more coriaceous leaf).

This is a somewhat variable species (always with distinctly obovate leaves) of lowland and low-lying forest, although a few collections have been made on ridge tops of low hills and one in high hill forest at 2,000 ft. (*Kep. 71248*). The hill collections have a distinctly more coriaceous leaf and might be considered as a variety. The species is characterised by the *Tarrietia*-like (mengkulang) bark, sticky syrup-coloured resinous exudate (c.f. varnish-like in var. *singapurense*), strongly rimmed leaves and the presence (usually) of stilt roots. It is commonly known as *bintangor batu*, denoting the harder and heavier timber than is usual in the genus.

We have been much puzzled by the *inophylloide* group, consisting of *C. inophylloide*, *C. inophylloide* var. *singapurense* and *C. intramarginale*, and its delimitation. These groups may be merely variants of one species, particularly as *Kep. 76055* from freshwater swamp forest in Trengganu has a varnish-like, non-sticky exudate, but we feel it better to adopt the present arrangement until more material is collected.

C. inophylloide, particularly the hill collections, closely resembles *C. sclerophyllum* in many characters but the leaf is smaller and the base of the midrib is not distinctly flattened on the upper surface.

In Check List as '*C. inophylloide* King'.

13. **Calophyllum inophylloide** King var. **singapurense** Henderson & Wyatt-Smith, **var. nov.**

A typo foliis minoribus rarius retusis differt.

A *tree* reaching c. 33 m. tall and 2 m. in girth, with definite, short, thin, spreading buttresses, usually with stilt roots and adventitious roots (Corner records *S.F.N. 28662* as having no buttresses and makes no mention of stilt roots or adventitious roots), bark dark brown, dippled with rough, narrow, shallow, distant (about 2 cm. apart) fissures, dark pink under bark, inner bark pink, exudate clear lemon-curd yellow to yellow-brown, varnish-like, non-sticky, copious, drying to lemon-yellow powder, sapwood pinkish. *Twigs* brownish grey when dry, much paler than in type, young twigs angular. *Terminal buds* more rufous tomentose and smaller than in type. *Leaves:* lamina coriaceous, somewhat glaucous in Singapore collections, small to medium-sized, obovate, c. 5–7 cm. × 3–4·5 cm., venation slightly more evident than in type, without strongly raised rim, petiole 0·9–1·2 cm. long, petiole and midrib on undersurface frequently slightly rusty brown tomentose, but the tomentum fugacious.

Inflorescences and *flowers* very much as in the type, the inflorescence tending to be longer (to c. 10 cm.) and the flowers slightly larger. *Fruit* similar to type, subglobose, slightly pointed, c. 2·8 cm. × 2 cm., pedicel 1·5–2·5 cm. long, pericarp thick, not brittle, in life green with pale green dots, when dry dark grey to black, dull and slightly rough with very obscure longitudinal striae, not smooth. **Plate IX. Fig. 4, D–H.**

TRENGGANU: Bukit Besi, Dungun, *Kep. 66957.*

JOHORE: Endau road, Mersing, *Kep. 54250*; Jemaluang F.R., *Kep. 69973, 69980, 69990, 69998, 73551*; Kluang F.R., *Kep. 71291, 72703, 76291*; 13½ mile, Mawai-Jemaluang road, *Corner s.n., 8-2-35* and *14-5-35*; Mawai, *Corner s.n. 21-5-34*; Panti F.R., *Kep. 53936, 63051, 70184.*

SINGAPORE: Gardens Jungle, *Ridley 6941, S.F.N. 28622, 34644*; MacRitchie Reservoir, *S.F.N. 32518* (TYPE, Holotype in Herb. Singapore).

This variety (?or species) is characterised by the small, obovate, coriaceous leaves, the thin angular twigs and the clear yellow to yellow-brown, *varnish-like, non-sticky* exudate. Its habitat is on low hills, having been found up to a maximum elevation of 700 ft. above sea level, and it appears to be restricted to Singapore Island and the south-east of the Malay Peninsula, although there is one record from Trengganu.

14. **Calophyllum macrocarpum** Hook. f., F.B.I. 1 (1894) 273; King, Mat. F.M.P. No. 2 (1890) 179; Ridl., F.M.P. 1 (1922) 187.

A tall *tree,* reaching c. 33 m. or more and c. 2 m. or more in girth, glabrous except for buds, without buttresses, bark dark brown speckled green, coarsely and deeply fissured, inner bark soft, thick, laminated, exudate canary yellow, sparse. *Twigs* smooth, strongly angled. *Terminal buds* short, pointed, more or less finely tomentose. *Leaves:* lamina rather large and coriaceous, more or less oblong or elliptic-oblong, or elliptic-lanceolate, sometimes tending to be obovate, apex usually shortly acute or acuminate, base rather long narrowed, variable in size, from c. 10 cm. × 3 cm. to c. 24 cm. × 7 cm., but sometimes smaller or larger, venation rather prominent and distinct and clear cut on both surfaces, petioles long, usually c. 2–4 cm.

Racemes axillary, usually less than half the length of leaves, rather laxly flowered, pedicels slender, c. 3 cm. long, *flowers* large, c. 3 cm. across, *sepals* 4, the two outer ones smaller than the inner ones, *petals* 4, smaller than the inner sepals. *Fruit* large, ellipsoid-ovoid, up to at least 14 cm. × 7 cm., dull dark green when ripe, mottled with small, darker green spots and with close, rather obscure longitudinal striations, pericarp firm, pale, juicy,

with sweet aromatic smell, the inner layers brown and fibrous, the fibres closely investing the large, pale, hard, woody seed. **Fig. 4, I.**

KEDAH: Kohmoi F.R., *Kep. 47869*; Sik, *Kep. 73822*; Sungkop F.R., *Kep. 73829*.

KELANTAN: Kemahang F.R., *Kep. 65184*; *68306*; Sg. Rek, Ulu Kelantan, *Kep. 65164*.

TRENGGANU: Belara F.R., Kuala Trengganu, *Kep. 76068*.

PERAK: Lenggong, *Kep. 10368*; Parit F.R., *Kep. 39466*.

SELANGOR: Rantau Panjang F.R., *Kep. 28915*; Pengkalan Kundang, *Kep. 32394*; Sungei Buloh F.R., *Kep. 43627*; Ayer Hitam F.R., *Kep. 53685*; Bukit Tunggal F.R., *Kep. 63602*; Bukit Lagong F.R., *Kep. 65538*; Public Gardens, Kuala Lumpur, *Kep. 1185*.

MALACCA: Bukit Sedanan F.R., *Kep. 18278*; Ayer Panas F.R., *Kep. 64164*.

NEGRI SEMBILAN: Sg. Menyala F.R., *Kep. 70472* (very large leaves).

PAHANG: Kuantan, *Kep. 3139*, *3706*; Bukit Beserah F.R., *Kep. 65678*; Kemasul F.R., *Kep. 10667*; Rotan Tunggal F.R., *Kep. 28497*; Bukit Kajang, Raub, *Kep. 40529*; Chermang Kiri, *Kep. 40338*.

JOHORE: Endau-Mersing road, *Kep. 70122*; Bukit Tanah Abang, *Lake & Kelsall 4054*; Kota Tinggi, *Ridley 15446*; Mawai-Jemaluang road, *S.F.N. 32240*; Sungai Sedili, *S.F.N. 37108*; Sungai Sedili Kechil *Corner s.n.*

A species of riverbanks, characterised by the very large fibrous fruit adapted for dispersal by water, the large flowers, the strongly angled young twigs and the long-petioled, rather conspicuously veined leaves. There are some differences in the size of flower in the material listed, and the variation in leaf size is considerable. The one record of an apparently wild plant from Singapore, coll. Goodenough at Changi in 1889, is doubtful.

In Check List as '*C. macrocarpum* H.f.'.

15. **Calophyllum javanicum** Miq., Pl. Jungh. 3 (1854) 292.—*C. subsessile* King, Ann. Bot. Gard. Calc. 5 (1896) 143, pl. 171; Ridl., F.M.P. 1 (1922) 187.

A *tree* reaching c. 35 m. tall and c. 1·5 m. in girth, without buttresses, but recorded as having knee-roots, bark golden yellow, green and brown, irregularly rough with shallow, longitudinal fissures, slightly roughly scaly, inner bark pink, in thick, papery layers, exudate golden, cloudy and sticky. *Twigs* quadrangular, polished, yellow. *Terminal buds* rather narrow, flattened from side to side, c. 4–6 mm. long. *Leaves:* lamina thinly coriaceous, elliptic-oblong, tip acute, or rounded, or shallowly and broadly retuse, base narrowed and cordate, very variable in size, normally between c. 8 cm. × 4 cm. and c. 15 cm. × 6 cm., but on some twigs as small as 5·5 cm. × 2 cm., and in saplings up to c. 23 cm. × 7 cm., almost sessile, the petiole stout, c. 4–5 mm. long, venation on both surfaces fine but distinct and raised.

Racemes solitary, c. 6 cm. long, *flowers* glabrous, c. 1·2 cm. across (fide King), *sepals* orbicular, concave, *petals* similar. *Fruit* globose, c. 2·5 cm. diam., probably smooth and dark green in life, coarsely wrinkled when dry. **Fig. 5, A–C.**

PERAK: sine loc., *Scortechini s.n., 253a*; Larut, *Kunstler 6877, 7311*; Lumut, *Kep. 43570*; Kroh F.R., *Kep. 71909.*

JOHORE: Pontian, *Kep. 70251, 70267.*

A tree of fresh water swamp forest, uncommon, but distinct from all other Malayan species in its cordate-based, subsessile leaves; it has very characteristic, almost white buds.

With some hesitation we have reduced King's species to Miquel's *C. javanicum*, which was originally inadequately described from Java, because of the great similarity in foliage.

In Check List as '*C. subsessile* ms.'.

16. **Calophyllum soulattri** Burm., Fl. Ind. 2 (1768) 121.—*C. spectabile* Willd., Mag. Berl. (1811) 80; King, Mat. F.M.P. No. 2 (1890) 175; Ridl., F.M.P. 1 (1922) 185, *p.p.*

A *tree*, recorded as up to c. 28 m. tall and c. 1 m. in girth, without buttresses, bark greyish to brownish, smooth but with tuberculate lenticels, bright yellow middle bark, inner bark light pink brown, exudate cream-white, watery but soon becoming sticky, copious, opaque. *Twigs* rather smooth, angular, older ones dark, youngest ones sometimes with a fugacious, mealy tomentum. *Terminal buds* narrow, pointed, rather coarsely ferrugineous tomentose, c. 1 cm. long. *Leaves:* lamina chartaceous, glabrous, dull, more or less ovate or ovate-oblong, sometimes elliptic-oblong, but nearly always broadest just above the base, tip more or less acute, base cuneate or often broadly cuneate, very variable in size, from c. 10 × 4 cm. to c. 20 cm. × 7 cm., both surfaces drying dull, or the upper somewhat shiny, venation on both surfaces raised, fine and rather close but not sharply clear cut, midrib frequently drying yellow brown, petiole 1·5–2 cm. long, drying yellowish or reddish brown.

Inflorescences axillary, umbelliform, the umbels sometimes pedunculate, the peduncle c. 2 cm. long, or subsessile, pedicels slender, c. 2 cm. long, flowers c. 1·2–1·5 cm. across, *sepals* 4, glabrous, more or less obovate-orbicular, the inner ones smaller than the outer ones, petals 0. Ripe *fruit* not seen, young fruit globose, mucronate with style remnant, drying dark coloured, not wrinkled, pedicel c. 2 cm. long. **Fig. 5, D.**

PERLIS: Bukit Ketri, *Kep. 73912.*

MALACCA: sine loc., *Maingay K.D. 167.*

PAHANG: Kuantan, *Kep. 15748*; Endau, *Kep. 29640.*

JOHORE: Sungai Gembut, *S.F.N. 36806*; Sungai Tuenseh, *Corner s.n. 10-6-34*; Pulau Pisang, *Wyatt-Smith s.n. 18-11-54*.

PULAU JARAK: *Kep. 71009* (a leaf specimen, apparently from a sapling, the identification of which is doubtful).

This species is not common in Malaya, although widespread. It appears to be usually riparian, although Corner records it as frequent with *Eugenia grandis* in dry forest behind *Casuarina* on the east coast of Johore.

The vernacular name *bintangor sempang* is rcorded from Johore by Corner.

Although we have not seen the type of *C. soulattri* Burm., we have followed Vesque, Burkill and other authors in reducing *C. spectabile* Willd. to it. The distinctive characters are the ovate leaves and the short, umbelliform inflorescences.

In Check List as '*C. spectabile* Willd.'.

17. **Calophyllum kunstleri** King, Mat. F.M.P. No. 2 (1890) 174; Ridl., F.M.P. 1 (1922) 182.

A *tree* up to c. 25 m. tall and c. 1 m. in girth, without buttresses, but loop roots may be present in swampy localities, bark fawn and brown, or fuscous brown, smooth with small lenticels grouped in vertical lines, or faintly and broadly lenticellate-fissured, horizontal furrows present, cut pale pink, soft, exudate yellowish brown, watery, jelly-like and somewhat cloudy, sometimes colourless, sometimes sticky. *Twigs* dark coloured when dry, youngest ones 4-angled and minutely pale tomentose. *Terminal buds* rather short, pointed, narrow, tomentose, c. 5–10 mm. long, side buds often supra-axillary. *Leaves:* lamina small to medium-sized, subcoriaceous to coriaceous, narrowly elliptic or oblong-elliptic, sometimes lanceolate, apex more or less acuminate, base tapered, variable in size, from c. 5·5 cm. × 1·5 cm. to c. 16 cm. × 6 cm., upper surface usually polished when dry, venation usually very oblique, close and rather obscure, petiole short, c. 1 cm. long.

Inflorescences axillary, umbelliform, peduncle very short, tomentose, with 4 narrow, tomentose bracts c. 7–8 mm. long at its apex, pedicels slender, glabrous, up to c. 1·5 cm. long but unequal and often much shorter, *sepals* 4, the two outer ones more or less oblong, 7–8 mm. long, reflexed in open flower, inner ones obovate, 8–9 mm. long, *petals* 0. *Fruit* globular, c. 1–1·5 cm. diam., pericarp rather thick, not brittle, reddish brown when dry, the surface rather coarsely wrinkled and usually smooth between wrinkles. **Fig 6, A–D.**

PERAK: Larut, *Kunstler 5328, 5374, 5459* (syntypes).

MALACCA: Bukit Sedanan, *Derry 119, 126*; Ayer Panas, *Derry 151*.

NEGRI SEMBILAN: Senaling Inas F.R., *S.F.N. 1753 (Kep. 628)*; Serting F.R., *Kep. 62876*; Pasir Panjang F.R., *Kep. 66506 (?)*; Cape Rachado, *Kep. 71466.*

PAHANG: Rompin, *Kep. 6538*; Tasek Bera, *Kep. 35850.*

JOHORE: Kota Tinggi, *Ridley 4185*; Mawai, *S.F.N. 30877, 34719, 34752*; Kluang F.R., *Kep. 76289*; Renggam F.R., *Kep. 71264.*

SINGAPORE: Bukit Mandai, *Ridley 1955*; Jurong road, *Nur s.n. 4-11-17.*

This species appears to be rather widely distributed in low-land forest, apparently not rarely in fresh water swamp forest, but not very common. It is distinct in its pointed leaves with usually very oblique venation, and in the short, umbelliform inflorescences with hairy bracts. Some of the collections placed here may not belong, and many more collections are needed of this species to be certain of its exact status.

18. **Calophyllum curtisii** King, Mat. F.M.P. No. 2 (1890) 176; Ridl., F.M.P. 1 (1922) 185.

A tall *tree*, recorded as reaching c. 48 m. in height and c. 2 m. in girth at breast height, without buttresses, bark pale grey or yellowish grey or biscuit-coloured, from almost smooth, with distant, shallow, boat- or diamond-shaped fissures (when young) to rough and shallowly fissured or rugose-fissured, inner bark pink or red, thick, exudate clear honey-coloured to dark yellow and sticky. Ultimate *twigs* rather copiously branched, generally in threes, rather pale, lenticellate, the youngest ones angular and slightly tomentose. *Terminal buds* narrow and pointed, pale to reddish tomentose, usually c. 4–5 mm. long, sometimes longer. *Leaves:* lamina usually small, subcoriaceous, usually elliptic to oblong-elliptic, or lanceolate, very variable in size, usually c. 5–7 cm. × 2–3 cm., but reaching c. 10 cm. × 4 cm. or as small as 2 cm. × 1 cm., sapling leaves longer and lanceolate, apex usually rounded but sometimes obtusely acute or more or less acuminate, base narrowed, upper surface usually shining when dry, lower surface paler and dull, venation very close and fine, not conspicuous but rather clearly cut, sometimes broken up by fine pustulations on the lower surface, petiole variable in length, usually rather short, c. 5–10 mm. long.

Inflorescences short, compact, umbelliform, few-flowered, ferrugineous tomentose, bracteate at base, pedicels short, more or less tomentose, lengthening in fruit, *flowers* c. 1 cm. diam., *sepals* 4, the two outer ones oblong-subobovate, c. 5 mm. long, finely hoary-tomentose outside, inner ones similar but broader, c. 5 ×

3·5 mm., slightly hoary at base only, *petals* 0. *Fruit* globose, up to c. 1·2 cm. diam., when dry the pericarp smooth or almost so, glabrous, crustaceous, dark reddish brown. **Fig. 3, F; Fig. 6, E–H.**

KELANTAN: Bukit Tapak Petri, *Kep. 32750*; Temangan, *S.F.N. 33506*; Pasir Puteh, *Kep. 68551*; Bertam, *Kep. 65172*.

TRENGGANU: Pulau Laut Tengah, *Kep. 30691*; Dungun, *Kep. 53365*.

KEDAH: Langkawi, *Curtis 3411*; Gunong Raya F.R., Langkawi, *Kep. 66415*; Perangin F.R., *Kep. 20687*; Enggang F.R., *Kep. 73833*; Sungai Rotan, *Kep. 18032*; Tampoi F.R., *Kep. 64295, 71168*; Bukit Perah, *Kep. 67877*; Kota Star, *Kep. 73659*; Kodiang, *Kep. 73654*.

PENANG: Government Hill, 500 ft., *Curtis 523* (TYPE); Muka Head, *Curtis 1425*; Batu Ferenghi, *Curtis 1425*; sine loc., *Kunstler 5225*.

PROVINCE WELLESLEY: Pantai Acheh F.R., *Kep. 66354*.

PERAK: Pondok Tanjong F.R., *Kep. 68201, 68203*; Bruas F.R., *Kep. 69423*; Ijok F.R., *Kep. 65554*; Parit F.R., *Kep. 34263*; Sg. Palai, Bukit Bujang Malaka, *Kep. 54732*; Behrang F.R., *Kep. 61087*; Tanjong Tualang F.R., *Kep. 63271*; Larut, *Kunstler 5446*; Taiping, *Kunstler 8497*; Ulu Kerling, *Kunstler 8597*.

SELANGOR: Weld road F.R., *Kep. 1831, 2853, 5185*; Bangi F.R., *Kep. 2647, 23666*; Ampang, *Kep. 9962*; Bukit Cheraka F.R., *Kep. 18718, 38176*; Ulu Gombak F.R., *Kep. 23651*; Sungai Buloh F.R., *Kep. 13341, 13342, 13343, 15266, 38157*; Kerling, *Kep. 32515*; Rantau Panjang F.R., *Kep. 32324 32330*; Ulu Langat F.R., *65601, 65603*.

MALACCA: Bukit Sungai, *Alvins s.n.*; sine loc., *Cantley 464*; Ayer Panas F.R., *Kep. 64163 64169*.

NEGRI SEMBILAN: Senawang F.R., *Kep. 1980*; Senaling Inas F.R., *Kep. 42820, 63854*; Serting F.R., *Kep. 62953, 62964, 63751*; Sungai Menyala F.R., *Kep. 64582, 64720, 75006*; Cape Rachado, *Kep. 71467*.

PAHANG: Baloh F.R., *Kep. 0829*; Kuantan, *Kep. 0882*; Kuala Lipis, *Kep. 1266*; Kemasul F.R., *Kep. 10652*; Aur F.R., *Kep. 15463*.

JOHORE: Sungai Kahang, *Kep. 5870*; Sungai Kayu, *S.F.N. 30865, 32324*; Jemaluang F.R., *Kep. 69967, 69981*; Mersing-Endau road, *Kep. 70103*; Kluang F.R., *Kep. 72702, 72704*; Ma'Okil F.R., *Kep. 71277*; Panchor, *Kep. 62819*.

SINGAPORE: Gardens Jungle, *S.F.N. 39434, 39444*.

A widespread, common species of lowland forest, with considerable variation in leaf-shape and size, the southern collections in general having smaller leaves. It has the short umbelliform inflorescences of *C. kunstleri* and *C. soulattri*, but is quite distinct from both. One of us (J. W.-S.) has seen *Wallich 4849a* from Moulmein in the Kew Herbarium and identifies it with *C. curtisii*. We have compared our material with *C. burmanni* Wight from Ceylon, which resembles *C. curtisii* in foliage characters, but *C. burmanni* has racemiform, not umbelliform, inflorescences.

It may later be possible to break up this group into smaller entities, but much more flowering and fruiting material is required before this can be done.

In Check List as '*C. curtisii*, '*C.* No. 55' and *C.* No. 56'.

19. **Calophyllum coriaceum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 33 m. alta, ramulis siccitate nigris, junioribus minute rubro-tomentosis, gemmis 2–2·5 cm. longis, acutis, minute rubiginoso-tomentosis. *Folia* valde coriacea, marginibus crassis, plus minusve oblonga, nonnunquam elliptica vel ovato-oblonga, c. 9 cm. × 3 cm. ad c. 17 cm. × 8 cm., apice obtusa, basi late acuminata, vel cuneata, vel fere rotundata, petiolo 1–2·5 cm. longo, subcrasso. *Inflorescentia* probabiliter terminalia, sub-paniculata, 9–10 cm. longa, minute rubiginoso-tomentosa; *flores* ad c. 3–3·5 cm. diam., *sepala* exteriora oblongo-ovata c. 10 mm. longa, minute rubiginoso-tomentosa, interiora tenuiora, maiora, orbicularia, *petala* 4 vel 5. *Fructus* ellipsoideus, plus minusve rostratus, c. 4–4·5 cm. longus, c. 2 cm. diam., siccitate crasse rugosus.

A stout *tree*, generally not very tall but a height of 33 m. has been recorded, c. 2·5 m. in girth, without buttresses, bark corky, fawn coloured or yellow-brown, roughly papery scaly, deeply, reticulately fissured, red brown under thin outer bark, inner bark soft, thick, pale pink, darkening to orange-brown on exposure, exudate sparse, slightly resinous, white (said to be yellow in *S.F.N. 18003*). *Twigs* blackish when dry, only the youngest with fine, red tomentum. *Terminal buds* long and pointed, reaching 2–2·5 cm., very finely rusty tomentose. *Leaves:* lamina very coriaceous, with thickened margins, more or less oblong, sometimes more or less elliptical, sometimes somewhat ovate-oblong, apex blunt, base broadly acuminate, or cuneate, or almost rounded, variable in size, from c. 9 cm. × 3 cm., to c. 17 cm. × 8 cm., sometimes proportionately narrower and then up to c. 21 cm. × 7 cm., venation fine, nearly horizontal, sometimes very obscure below and almost invisible to the naked eye, less obscure above and appearing under a lens as low, raised, rounded ridges, petiole rather long and stout, usually over 1 cm. long and reaching 2–2·5 cm.

Inflorescences apparently terminal, subpaniculate, 9–10 cm. long, finely reddish-rusty tomentose, *flowers* large, fragrant, c. 3–3·5 cm. across, *sepals* 4, the outer two oblong-ovate, c. 1 cm. or more long, reddish-rusty tomentose, inner ones thinner in texture, larger and more orbicular, *petals* 4 or 5, cream-coloured. *Fruit* ellipsoid, more or less beaked, c. 4–4·5 cm. long, c. 2 cm. diam., pericarp thick, not brittle, smooth and green in life, coarsely wrinkled and almost black when dry. **Plate X. Fig. 7, A, B.**

Selangor: Gunong Nuang F.R., *Kep. 51818.*

Pahang: Fraser Hill at 4,000 ft., *Kep. 66615, 76053, 76270, S.F.N. 11463*; Cameron Highlands and vicinity, *Kep. 13627* (Type, Holotype in Herb. Singapore), *27154, 27192, 27302, 30960, 34015, 66602, S.F.N. 18003, 23653.*

Aboriginal name at Cameron Highlands—*Mintak.*

A montane species, common at Cameron Highlands and Fraser Hill. The large, very coriaceous and oblong leaves, long terminal buds, rather large inflorescences and large flowers distinguish it.

This species was recognised by Symington prior to the 1939–45 World War, and we have retained his manuscript name of *C. coriaceum* under which he had segregated all collections at Kepong.

In Check List as '*C. coriaceum* ms.'.

20. **Calophyllum sclerophyllum** Vesque, Epharm. 2 (1889) t. 33; et in DC., Monogr. Phan. 8 (1889) 587.

A tall *tree*, recorded as up to c. 45 m. in height and nearly 3 m. in girth, with stilt and knee roots, bark pale to greeny-fawn or light brown, scaly, channelled to shallowly fissured (resembling bark of *Tarrietia*), with red-brown, papery, vertical lenticels, inner bark soft, fibrous, pink to reddish- or dark orange-brown, exudate clear honey-coloured with a distinct greenish tinge, heartwood red. *Twigs* stout, 4-angled, glabrous. *Terminal buds* narrowly conical, pointed, c. 1–1·5 cm. long, very minutely tomentose. *Leaves:* lamina large, broad, very coriaceous, oblong or oblong-ovate, up to c. 16 cm. × 8 cm., apex rounded or widely retuse or sometimes obtusely acute or apiculate, base narrowed and more or less decurrent on petiole, both surfaces drying pale reddish brown, margin of blade thickened, venation below slightly raised but not clear cut, slightly more obvious above in the form of V-shaped ridges and furrows, midrib much raised below, on the upper surface broad and flat at the base then narrowing into a sunk channel, petiole stout, flattened, up to c. 2 cm. long.

Racemes axillary, lax, up to c. 9 cm. long, finely reddish mealy-tomentose, pedicels slender, up to c. 3 cm. long on the lower flowers, flower-buds nearly 1 cm. diam., *sepals* 4, the two outer ones orbicular, tough, c. 7 mm. diam., finely reddish tomentose, the inner ones slightly larger and thinner, *petals* 4, smaller and somewhat narrower than the sepals. *Fruit* ovoid-oblong to globular, c. 3 cm. diam., on a peduncle 2–3 cm. long, pericarp very thick, drying dull reddish brown to almost black, the surface very finely and rather closely wrinkled. **Fig. 7, C.**

TRENGGANU: Bukit Bauk F.R., *Kep. 76078.*

PAHANG: Kuantan, *Kep. 4735, 31611*; Endau, *Kep. 17293, 31602*; Ulu Rompin, *Kep. 2735, 2743*; Pekan, *Kep. 65697.*

JOHORE: Mawai, *S.F.N. 34728*; Gunong Arong F.R., *Kep. 70069, 70107, 71310*; Jemaluang F.R., *Kep. 71891*; Endau-Mersing road, *Kep. 76279*; Sungai Sedili, *Corner s.n. 29-7-32*; Sungai Semandan, *Corner s.n. 16-6-34*; Mawai, *Corner s.n. 15-5-34, 21-5-34* and *7-10-34.*

A distinct species of fresh water swamp forest, originally described from Borneo, with stilt roots, knee roots, large, very coriaceous, broadly oblong to obovate leaves with a robust petiole

which dries black as does also the base of the midrib, strongly angular twigs, and large flowers in lax racemes. It is close to *C. inophylloide* but has larger and very coriaceous leaves. It is frequently known as *penaga bayan*, and has been collected also under the names of *penaga*, *penaga ayer*, *bintangor batu* and *bintangor jangkang*.

In Check List as *'C. subluridum'*.

21. **Calophyllum subhorizontale** Henderson & Wyatt-Smith, **sp. nov.**

Arbor c. 10–20 m. alta, ramulis robustis, angulosis, glabris, flavis, cortice nitido, gemmis c. 5–6 mm. longis, minute brunneo-tomentosis. *Folia* vix coriacea, plus minusve obovata vel oblongo-elliptica, ad c. 24 cm. × 9 cm., apice rotundata vel breviter obtuso-acuminata, basi acuminata, nervis lateralibus subhorizontalibus, petiole c. 1–2 cm. longo. *Racemi* plerumque breves, nonnumquam ad c. 7 cm. longi; *flores* glabri; *sepala* 4, exteriora orbicularia, 8–10 mm. diam., interiora minora, plus minusve oblonga; *petala* 4 vel ?6. *Fructus* ovoideus, acutus, ad c. 4 cm. longus, in sicco crasse rugosus.

A medium-sized *tree*, c. 10–20 m. tall and under 1 m. in girth, bark yellowish with dark patches, inner bark white, exudate yellow, sticky. *Twigs* stout, angled, smooth, the youngest ones brownish, older ones yellowish. *Terminal buds* short and rather squat, c. 5–6 mm. long, brown tomentose. *Leaves:* lamina large, rather soft-textured, usually more or less obovate or oblong-elliptic, up to c. 24 cm. × 9 cm., tip rounded or shortly and bluntly apiculate, base acuminate, venation subhorizontal, raised on both surfaces, not sharply cut below, thinner and sharper above, rather distant, petioles usually short, c. 1 cm. long, bordered by the decurrent margins of the blade.

Racemes from the upper leaf-axils, usually short and dense, occasionally rather lax and reaching c. 7 cm. long, only slightly rusty tomentose, *flowers* rather large, glabrous, *sepals* 4, the two outer ones orbicular, 8–10 mm. diam., the inner ones smaller and more oblong, *petals* 4 or ? 6. *Fruit* rather narrowly ovoid acute, c. 4 cm. or more long, rather coarsely wrinkled when dry, smooth between the wrinkles, the pericarp crustaceous, reddish to blackish brown. **Plate XI. Fig. 8, A.**

TRENGGANU: Kemaman, *Corner s.n.*

SELANGOR: Sungai Buloh F.R., *Kep. 5315.*

NEGRI SEMBILAN: Angsi F.R., *Kep. 23817.*

PAHANG: Raub, *Kep. 23381*; Bukit Goh F.R., *Kep. 17316*; Benchah F.R., *Kep. 658* (TYPE, Holotype in Herb. Singapore); Kuala Lipis, *Kep. 1267*; sine loc., *Kep. 1151.*

Not common in lowland forest.

A distinct species with its rather large more or less obovate leaves with almost horizontal venation, short dense inflorescences and smooth, ovoid, pointed fruits. We have compared it with *C. macrophyllum* Scheff., a very imperfectly known species from Gebeh Island, east of Halmaheira, but have decided that they are not conspecific, because of the improbable distribution and because the midrib on the undersurface of the leaf in *C. macrophyllum* is prominently keeled but more or less rounded in *C. subhorizontale*, and the venation in the latter is more sharply cut on the upper surface of the leaf.

22. **Calophyllum scriblitifolium** Henderson & Wyatt-Smith, **sp. nov.**

Arbor c. 46 m. alta, ramulis robustis, plus minusve angulosis, junioribus nigris, minutissime rufo-tomentosis. *Folia* valde coriacea, oblonga, apice plerumque leviter emarginata et mucronata, basi late cuneata vel rotundata, margine multo revoluto, c. 11 cm. × 2·5 cm. ad c. 20 cm. × 7·5 cm., nervis lateralibus subhorizontalibus, subtus leviter prominulis, indistinctis, supra prominulis, nervo medio utrinque minute tomentoso, petiolo robusto, c. 1·5–2·5 cm. longo. *Racemi* axillares, pauciflori, ad c. 6 cm. longi, minutissime rufo-tomentosi, pedicellis ad c. 6 mm. longis; *flores* c. 2 cm. lati; *sepala* exteriora orbicularia, concava, extus minute pallide tomentosa, c. 8–9 mm. diam., interiora obovata, c. 11 mm. × 7 mm.; *petala* 0. *Fructus* oblongo-globosus, c. 2·2 cm. longus et 1·5 cm. latus, umbonatus, in sicco niger.

A large *tree*, reaching c. 46 m. or more in height and c. 3 m. in girth, without buttresses, bark red brown or grey, rough, coarsely fissured, inner bark thick, rather soft, pinky red, exudate yellow to yellowy-cream coloured, milky, sticky, copious. *Twigs* stout, more or less angled, with large scars, dark coloured, the youngest very minutely reddish tomentose. *Terminal buds* large, narrowly lanceolate, acute, very finely red scurfy, 2–3 cm. long. *Leaves:* lamina medium-sized to large, very coriaceous, oblong, apex rounded and usually more or less shallowly emarginate with the tip of the midrib projecting as a mucro, base widely cuneate or rounded, from c. 11 cm. × 2·5 cm. to c. 20 cm. × 7 cm. (leaves not flattened), margins strongly revolute in the dried leaf and the edge thickened, venation almost horizontal and straight, sometimes slightly oblique and curved, slightly raised below and indistinct, raised above and a little more distinct, mid-rib wide at base above and widely and shallowly channelled, the channel narrowing towards the leaf-tip and disappearing, the upper part raised and rounded, its whole length more or less finely scurfy, on the undersurface the midrib very prominent throughout its whole length and more or less scurfy, petiole stout, flattened above, c. 1·5–2·5 cm. long.

Racemes axillary, rather lax and few-flowered, up to c. 6 cm. long, rachis and pedicels finely reddish scurfy, pedicels short, to c. 6 mm. long, *flowers* rather large, c. 2 cm. or a little more across, *sepals* 4, the outer two thick, orbicular, concave, reflexed in the open flower, closely pale tomentose outside, c. 8–9 cm. diam., inner ones thin, obovate from a broad claw, c. 11 mm. × 7 mm., margins at tip slightly lacerate, *petals* 0. *Fruit* (probably unripe) oblong-globose, umbonate, hard, green when fresh, black when dry, thick not brittle smooth coat, about 2·2 cm. long by 1·5 cm. across, pedicel 2 cm. long, stout. **Plate XII. Fig. 8, B, C.**

PERAK: Utan Melintang F.R., Lower Perak, *Kep. 69001* (TYPE, Holotype in Herb. Kepong); Tanjong Tualang F.R., *Kep. 45675, 45689.*

JOHORE: Muar to Parit Sulong road, *Kep. 70211, 80558.*

A very distinct large species of peat and fresh water swamp forest, distinguished by its thick, coriaceous, oblong leaves, usually drying pale, with strongly revolute margins, its rather short inflorescences and the thick, pale tomentose outer sepals and thin, obovate inner ones.

In the Check List this was included as '*C. revolutum* ms.' but we have since found that this name has already been used in the genus.

23. **Calophyllum sp.**

A tall *tree*, recorded as reaching 33 m. or more and up to 2 m. in girth, buttresses absent or very small, bark smoothish with fine obscure crackings and horizontal ridges, biscuit coloured, yellowish greeny grey or pale grey with abundant, long, vertical, yellowish-fawn lenticels giving the appearance of fine fissures, outer bark thin and brittle, under bark orange brown occasionally green, inner bark soft, fibrous, pinkish orange, exudate saffron yellow, cloudy, resinous, drying quickly and coagulating to a powdery substance which is easily rubbed away, sapwood browny-orange. *Twigs* stout, glabrous, *almost white*, the older ones terete, the youngest angled and apparently with dark bark, but the dark colour soon disappearing. *Terminal buds* narrowly ovate-acuminate, c. 1–1·3 cm. long, very minutely reddish tomentose. *Leaves* thinly coriaceous, rather large, usually elliptic, sometimes more or less oblong-elliptic, apex very shortly and abruptly acute, the acumen c. 5 mm. long, base broadly acuminate or cuneate, from c. 11 cm. × 5 cm. to c. 15 cm. × 7 cm., margin narrowly thickened and cartilaginous, slightly revolute, both surfaces drying light brown, the upper slightly darker than the lower and shining, venation fine, close, raised and clear cut on the upper surface,

raised below but less sharply cut, midrib narrowly raised and channelled above, prominent below, rounded and longitudinally ribbed, *petiole long*, usually rather slender, drying dark, with a broad, shallow channel above, c. 2·5–3·5 cm. long, fallen leaf pale fawn with dark midrib.

Inflorescence, flowers and fruit unknown. **Plate XIII. Fig. 8, D.**

JOHORE: Endau road, Mersing, *Kep. 70059, 71892, 76284*; Gunong Arong F.R., *Kep. 69975, 71317*; Jemaluang F.R., *Kep. 69984, 69987, 72906, 73459, 73466, 73468, 74160.*

This may prove to be *C. palustre* Ridl. from Borneo when flowering material is found, but in our plant the leaves are more elliptic, with longer petioles and the twigs are pale, not dark coloured. It is a common tree of the low-lying forest in the Mersing District of Johore.

In Check List as '*C.* No. 51.'

24. **Calophyllum ferrugineum** Ridl. in Journ. As. Soc. Str. Br. 54 (1910) 17; F.M.P. 1 (1922) 184.

A *tree*, reaching c. 25 m. tall or more and c. 1·5 m. in girth, though usually smaller, without buttresses, bark smooth to rough, reddish brown to dark grey brown, with faint lenticellate fissures, cut reddish or pink, exudate very pale crystal clear honey-coloured or pale off-white, sticky but soon setting. *Twigs* rather slender, dark coloured when dry, the youngest ones angled, more or less ferrugineous tomentose. *Terminal buds* short, bluntly pointed, densely red tomentose. *Leaves:* lamina medium-sized, stiffly coriaceous, usually more or less elliptic-oblong to spathulate, sometimes lanceolate, from c. 5 cm. × 2 cm. to c. 12 cm. × 5 cm., usually c. 8 cm. × 3·5 cm., apex bluntly acute, or rounded, or slightly retuse, base narrowed, lamina edge concave near petiole, venation on upper surface close, fine and often obscure, fine and more distinct on the lower surface, midrib narrowly channelled at base above, prominent below, usually persistently red tomentose below but sometimes almost or quite glabrous, upper surface usually with slight glaucous bloom, petiole variable, up to c. 2 cm. long; dried leaf characterised by a slight ridge, parallel with, close to and on both sides of the midrib on the lower face.

Racemes axillary, variable in length, sometimes with only 2–4 pairs of flowers and a terminal one, reaching c. 8 cm. long, laxly flowered, peduncle red tomentose, pedicels slender, white in life, glabrous or almost so, up to c. 2 cm. long, *flowers* fragrant, c. 1·5 cm. across, *sepals* 4, the outer two ovate-orbicular, concave,

slightly hairy on margins, inner ones larger, obovate, all reflexed in open flower, *petals* 0. *Fruit* ellipsoid or narrowly ovoid, c. 2·5–3 cm. long, pale green and slightly glaucous in life, pericarp coarsely wrinkled when dry, smooth between wrinkles, thin, crustaceous, usually pale brown. **Plate XIV. Fig. 9, A, B, C.**

JOHORE: Panchor, *Kep. 62815, 62818.*

SINGAPORE: sine loc., *Cantley s.n., 174*; Botanic Gardens, Ridley *1956, 4799* (syntype), *6934, 8414, 8415, 10842* (syntype), *S.F.N. 236, 28196, 28197, 28198, 28199, 28200, 39435, 39441, 39442, 39443, 40266*; Bukit Timah, *S.F.N. 34646, 35797, 35943*; Tanjong Gol, *Ridley 1959*; Changi, *Ridley 5747.*

Known only from lowland forest on Singapore Island, where it is common, and the extreme south of Johore. It is readily distinguished by its more or less oblong, spathulate, stiff, medium-sized leaves, which are often tomentose on the midrib below, the two slight 'ridges' in the dried leaf alongside the midrib on the lower face, the ferrugineous tomentose bud, quadrangular young twigs and peduncles, and the pointed, ellipsoid fruit. It closely resembles *C. retusum.*

25. **Calophyllum ferrugineum** Ridl. var. **neriifolium** (Ridl.) Henderson & Wyatt-Smith, **var. nov.**—*C. neriifolium* Ridl. in Journ. Roy. As. Soc. Str. Br. 82 (1920) 170; F.M.P. 1 (1922) 188.—*C. oblongifolium* Ridl., F.M.P. 1 (1922) 184.—*C. pulcherrimum* var. *oblongifolium* T. Anders. in Hook. f., F.B.I. 1 (1874) 272.

A *tree* reaching c. 28 m. tall and c. 1·5 m. in girth at breast height, without buttresses, bark greeny-grey, greenish brown or fawn, smoothish, with dark brown, long, often diamond-shaped lenticels, or with shallow, anastomosing, distant fissures, cut pinkish, stringy, exudate colourless or clear very pale brown, very sticky. *Twigs* rather slender, dark reddish brown, the youngest ones angular and with a quickly deciduous, rather coarse and sparse, reddish tomentum. *Terminal buds* small, c. 4–5 mm. long, pointed, sometimes abruptly so, closely reddish or brownish tomentose. *Leaves* glabrous, rather small, stiffly coriaceous, narrowly oblong or narrowly oblong-lanceolate to elliptic-oblong, sometimes more or less elliptic, sometimes with a tendency to be narrowly obovate, apex somewhat narrowed and rounded, or broadly and bluntly acute, occasionally retuse, base cuneate, the narrower leaves up to c. 9 cm. × 2 cm., the wider ones up to c. 7·5 cm. × 4 cm., usually drying reddish brown on both surfaces, midrib usually narrowly channelled towards base above, slender and

raised in its upper 2/3, rather prominent below and more or less keeled, venation usually inconspicuous or obscure, often not visible on the upper surface, but sometimes raised and very close and fine, usually more easily visible on lower surface, close, fine, not sharply cut, petiole rather slender, variable in length, usually less than 1·5 cm. long; dried leaf characterised as in *C. ferrugineum* by slight 'ridge', parallel with, close to and on both side of midrib on lower face.

Racemes axillary, 7–9-flowered, up to c. 6–7 cm. long, slender, copiously produced, peduncle with deciduous, sparse, rather coarse reddish tomentum, pedicels slender, glabrous, up to c. 1 cm. long, lengthening in fruit, *flowers* glabrous, c. 1–1·6 cm. across, *sepals* 4, the outer two rather tough, orbicular-obovate, concave, c. 6–7 mm. long, rather strongly veined, thickened at base, the inner ones thinner, broadly obovate, c. 8 mm. long, minutely ciliate on the apical margins, *petals* 0. *Fruit* oblong or broadly oblong, c. 2–2·5 cm. long, apex very broadly and bluntly pointed, or rounded, pericarp thin and brittle, pale and smooth when dry but breaking up easily and becoming coarsely wrinkled, green to glaucous-blue in life. **Fig. 9, D.**

KELANTAN: Sungei Tekal, *S.F.N. 19743.*

TRENGGANU: Kemaman, *Kep. 44163*; Dungun, *Kep. 76080.*

PERAK: Ulu Slim, 400–600 ft., *Kunstler 10885*; Ulu Bubong, 800–900 ft., *Kunstler 10910, 10929.*

SELANGOR: Sungai Buloh F.R., *Kep. 2264*; 22nd mile Kepong to Kuala Selangor road, *Kep. 66201*; Klang Gates, *Kep. 66609*; Semangkok F.R. at 1,500 ft., *Kep. 76195, 76197, 76198.*

MALACCA: sine loc., *Maingay K.D. 173* (type of *C. pulcherrimum* var. *oblongifolium* T. Anders.), *Alvins s.n., 983*; Mount Ophir, *Ridley 3223* (TYPE).

NEGRI SEMBILAN: Gunong Angsi, *S.F.N. 11655*; Tampin, *S.F.N. 1379*; Sungai Menyala F.R., *Kep. 18503*; Cape Rachado, *Kep. 70330, 71347.*

PAHANG: Rompin, *Kep. 2714*; Beserah F.R., *Kep. 65699, 76120*; Kuantan, *Kep. 76115*; Baloh F.R., *Kep. 40213.*

JOHORE: Banang F.R., *Kep. 74110.*

This variety differs from *C. ferrugineum*, which appears to be confined to Singapore Island, and the Johore mainland opposite, in the smaller leaves, glabrous on the midrib below, the less hairy peduncle of the inflorescence, and in the less pointed fruit. We have been puzzled, however, by this variety and further collections may prove that we have taken too broad a view and that some of the above collections may not in fact belong.

It appears to be widespread in low hill forest, frequently occuring on ridge tops.

26. **Calophyllum retusum** Wall., nom. nud., Planch. & Tri., Ann. Sci. Nat. 4, 15 (1861) 265; King, Mat. F.M.P. No. 2 (1890) 176, *p.p.*; Ridl., F.M.P. 1 (1922) 184.

A *tree* reaching c. 50 m. tall and over 2 m. in girth, without buttresses, bark smooth, grey, fawny-brown or green-brown to dark brown, with numerous, long, brown, vertical lenticels, giving a rough appearance, and fine shallow cracks, cut soft, pinky red, exudate yellowish or amber-coloured, clear. *Twigs* brownish to blackish, the youngest ones angled and grooved, glabrous or deciduously red tomentose and frequently with glaucous bloom. *Terminal buds* narrow, pointed, very finely reddish scurfy or reddish tomentose, usually c. 5–9 mm. long. *Leaves:* lamina medium-sized, rigidly coriaceous, usually oblong-elliptic or rather broadly or narrowly oblong, apex usually more or less rounded, often emarginate, base usually cuneate, sometimes very broadly so, frequently rounded, variable in size, from c. 4 cm. × 2·5 cm. to c. 12 cm. × 5 cm., venation very fine and close and obscure, usually obscure below and very little raised, slightly more clear cut and more easily visible above, midrib narrowly channelled at base above, prominent below, petiole usually rather long and slender, to c. 2 cm. long, frequently covered with glaucous bloom.

Racemes from the upper leaf-axils, very short, few-flowered, with the flowers close together, c. 2 cm. long, peduncle very sparsely reddish tomentose, rest glabrous, lower pedicels less than 1 cm. long, *flowers* c. 1·7 cm. across, glabrous, *sepals* 4, the outer two tough and rather thick, orbicular, concave, reflexed in open flower, c. 6 mm. diam., the inner ones larger and thinner, but still rather thick at base, nearly orbicular, c. 8 mm. diam., *petals* 0. *Fruit* when dry rather broadly oblong to almost globose, c. 1·8–2·2 cm. × 1·4–1·6 cm., blunt, the apex with a hollow and minute style remains, pericarp rather thick, slightly brittle but not breaking up, outer surface dull pale reddish or greyish brown, coarsely wrinkled, smooth between wrinkles, inner surface polished, with darker longitudinal markings, testa thin, crustaceous. **Plate XV. Fig. 9, E, F.**

PAHANG: Kuantan-Pekan road, *Kep. 62601*; Menchali F.R., *Kep. 67623*.

SELANGOR: Telok F.R., *Kep. 23230, 46205, 46207*; Kuala Selangor, *Kep. 66208*; Klang, *Kep. 43692*; Kuala Langat F.R., *Kep. 53951, 53977*; Sungai Tinggi, Kuala Selangor, *S.F.N. 34087*.

JOHORE: Kota Tinggi-Mawai road, *S.F.N. 29050*; Pengkalan Raja, *S.F.N. 36637*; Pontian, *Kep. 70261, 75603*; Sungai Benut, *Kep. 73053*; Ayer Itam North F.R., Muar, *Kep. 66643, 70163, 70193, 70194, 70205, 70206, 74101, 74102, 74103*; Muar, *Kep. 74107*.

SINGAPORE: *Wallich 4846* (TYPE); Nee Soon, *S.F.N. 39252*; Jurong, *S.F.N. 26047, 26159, Corner s.n. 13-11-32*.

Also a collection represented in Herb. Calcutta and Herb. Singapore, *No. 463*, without locality or collector.

King in the Materials reduces *C. pisiferum* Pl. & Tri. to this species, but the two are quite distinct. He correctly excludes *C. amoenum* Wall. from his synonymy.

This large tree is apparently confined to the southern half of Malaya in peat swamp and fresh water swamp forest. It resembles superficially *C. ferrugineum* Ridl., but differs in being practically glabrous, in the much shorter inflorescences and different fruit, quite distinct from that of *C. ferrugineum*, which is larger, pointed, and with thinner and more brittle pericarp; and in the *straight* lamina edge which joins the base of the midrib at an angle of 45–90° as compared with a concave lamina edge joining at an angle of less than 30° in *C. ferrugineum*. The fallen leaf, and the herbarium leaf after a few years, is a rich red brown colour compared with the much paler brown of *C. ferrugineum*.

27. **Calophyllum floribundum** Hook. f., F.B.I. 1 (1874) 272; King, Mat. F.M.P. No. 2 (1890) 175; Ridl., F.M.P. 1 (1922) 184.—*C. prainianum* King, Mat. F.M.P. No. 2 (1890) 175; Ridl., loc. cit. p. 186.—*C. venustum* King, Mat. F.M.P. No. 2 (1890) 180; Ridl., loc. cit. p. 186.—*C. foetidum* Ridl. in Journ. Roy. As. Soc. Str. Br. 54 (1910) 18, *pro maxime parte* et F.M.P. 1 (1922) 186 *p.p.*—*C. lanceola* Ridl. in Journ. Roy. As. Soc. Str. Br. 82 (1920) 170 et F.M.P. 1 (1922) 182.—*C. pulcherrimum* Ridl., F.M.P. 1 (1922) 182, *p.p.*, non Pl. & Tri.

A medium-sized to rather tall *tree*, reaching c. 30 m. in height and c. 2 m. in girth, without buttresses, or with small, thick buttresses, bark fawn, dark grey and yellow-brown, sometimes brown and grey-green with pinky red patches, rather coarsely but shallowly boat-shaped fissured, or smooth and cracked, dark red under outer bark, inner bark soft, pink, laminated, exudate clear (occasionally slightly cloudy), yellow or treacle-coloured, sticky. *Twigs* glabrous, usually grey, the youngest ones angular, slender and usually brown. *Terminal buds* small, short, pointed. *Leaves:* lamina varying much in size and shape, subcoriaceous, normally rather broadly oblong, tip rather abruptly and shortly and bluntly acuminate, base usually much narrowed, from c. 4 cm. × 1·5 cm. to c. 10 cm. × 4 cm., usually c. 6–7 cm. × 3–3·5 cm., both surfaces usually shining when dry, venation usually rather conspicuous on both surfaces, close, raised and generally clear cut, sometimes rather obscure in particular on lower surface, midrib raised on both surfaces, leaf margin nearly always slightly thickened and characteristically pale in colour, petioles slender, rather short, c. 5–8 mm. long.

Racemes short, slender, glabrous, usually numerous and arising from the leaf-axils all along the twigs, usually not more than c. 3–4 cm. long, usually 5–9 flowered, sometimes 11-flowered, pedicels very slender, very variable in length, reaching c. 2 cm. long, *flowers* small, usually 6–8 mm. across, but sometimes larger, fragrant at first, later foetid, sepals and petals white, *sepals* 4, saccate, the outer two rather smaller and tougher than the inner ones, glabrous, broadly obovate, rounded, c. 2·5–5 mm. long, reflexed in open flower, *petals* 2 or 4, but not always present, similar in shape and size to inner sepals. *Fruit* when dry very broadly ellipsoid to globose, reaching nearly 2·5 cm. long, apex rounded, pericarp very thin and brittle, breaking up easily, pale brown or pale reddish brown, quite smooth and slightly polished, separating from a thin, fibrous, pale endocarp, testa rather thin and brittle, resembling the pericarp. **Plate XVI. Fig. 10, A–I.**

KEDAH: Kedah Peak, *Ridley 5751* (type collection of *C. lanceola* Ridl.), at 2,500 ft., *S.F.N. 5176*, at 3,000 ft., *S.F.N. 14872*; Gunong Jerai F.R., *Kep. 17925*, *59638*, *73856*; Bukit Malut, *Kep. 7683*; Langkawi, *Ridley 15540*; Bukit Sawak F.R., Langkawi, *Kep. 66442*; Gunong Raya F.R., Langkawi, *Kep. 71194*.

KELANTAN: Pasir Mas, *Kep. 66804*, *66809*.

PENANG: Pantai Acheh F.R., *Kep. 50819*.

PERAK: Larut, *Kunstler 3378*, *5403*, *7285*; Larut, *Kunstler 5366*, *7243* (syntypes of *C. prainianum* King); Batang Padang, *Kunstler 7763* (type collection of *C. venustum* King); Taiping, *Burn-Murdoch 330*; Taiping Hill, *Anderson 114*; Gunong Haram Parah, *Scortechini 682*; Lumut F.R., *Kep. 76725*; Batu Undan F.R., *Kep. 54223*.

SELANGOR: Ginting Simpah, *Kep. 12854*.

MALACCA: sine loc., *Maingay K.D. 169*, *K.D. 170* (TYPE); Bukit Bruang, *Derry 393*, *443*, *514*.

NEGRI SEMBILAN: Serting F.R., *Kep. 62955*; Senaling Inas F.R., *Kep. 62882*.

PAHANG: Rompin, *Kep. 15452*; Kuantan, *Kep. 2712*, *15638*; Rotan Tunggul F.R., *Kep. 23389*; Kerdau, *Kep. 29997*; Baloh F.R., *Kep. 40164*, *40218*, *40220*, *40226*, *66646*, *76144*.

JOHORE: Mawai, *S.F.N. 34748*, *34751*, *37387*; Kangka Sedili Ketchil, *S.F.N. 28599*; Lenggor F.R., *Kep. 72652*; Jemaluang F.R., *Kep. 69993*, *71896*, *73463*; Gunong Arong F.R., *Kep. 71312*.

SINGAPORE: Gardens Jungle, *Ridley 6935*, *11958*, *14119* (syntypes of *C. foetidum* Ridl.), *Ridley 4800*, *4923*, *S.F.N. 15358*, *24501*, *24976*, *28659*, *36254*, *36255*, *39433*, *39445*, *40267*, *Gardens No. 1691*; Mandai road, *S.F.N. 33143*, *Kiah s.n.*, *Corner s.n.*; Bukit Timah, *S.F.N. 34650*, *38848*, *Kep. 70530*.

The bulk of the material quoted above has hitherto been identified, wrongly, with *C. pulcherrimum* Wall.

We have taken a wide view of this undoubtedly variable species, but it seems better to do this than to attempt to split it up into smaller entities without more knowledge of it. As we have defined it, *C. floribundum* is a widespread species, showing great variation

in shape and size of leaves (even on a single tree), in size of flower and perhaps of fruit, in the number of petals, and in the habitat. *C. foetidum*, as originally described by Ridley, is a mixture. Of the syntypes quoted by him in the original description we have assigned *Ridley 13305* to *C. pulcherrimum* Wall. *Ridley 6935*, *11958* and *14119* we cannot separate from *C. floribundum*. The remaining syntype is a collection by Derry from Malacca, no number quoted. *Derry 514* in Herb. Singapore may be this, although the fruits of this collection do not correspond to Ridley's description. Our attempts to sort *C. foetidum* from *C. floribundum* on apparent fruit differences were not supported by subsequent collections.

C. floribundum is characterised by the pale leaf margin, the short, copious inflorescences of usually small flowers, and the long, angular, glabrous, pale brown twigs. It is a species mostly of lowland and low-lying forest.

In Check List as '*C. pulcherrimum* Wall.'

28. **Calophyllum pulcherrimum** Wall. Cat. nom. nud., Planch. & Triana in Ann. Sc. Nat. 4, 15 (1861) 278. — *C. plicipes* Miq., Fl. Ind. Bat. Suppl. 1 (?1862) 499. (There is some doubt as to the exact date of publication of Miquel's name. On the title page of the publication quoted it is given as 1860, but van Steenis in Bull. Jard. Bot. Buit. 13 (1934) 285 says that pp. 309 onwards may have been issued in 1862. We therefore retain the better-known name.

A medium-sized to tall *tree* recorded as up to c. 30 m. in height and c. 1·5 m. in girth, without buttresses, bark greyish or yellow brown, smooth, with vertically elongated, brown lenticels, exudate clear, honey coloured, sticky. *Twigs* slender, terete, drying dark coloured and almost smooth, the youngest ones angled, glabrous. *Terminal buds* very small, narrow, abruptly pointed, almost glabrous, 2–3 mm. long. *Leaves:* lamina small, subcoriaceous, narrowly elliptic, oblong-elliptic or lanceolate, from c. 3·5 × 1·5 cm. to c. 9 cm. × 3·75 cm., usually c. 5 cm. × 2·5 cm., apex bluntly acute or sometimes abruptly and shortly acuminate, base usually rather long narrowed on to petiole, venation on both surfaces usually inconspicuous, slightly raised, very rarely invisible below, midrib usually sunk in a channel below, raised above with a narrow median channel, petiole slender, c. 7–10 mm. long, strongly channelled; fallen leaves with red-brown upper surface and pale margin to lamina.

Racemes very slender, up to c. 6–7 cm. long, from the upper and terminal leaf-axils, glabrous, *flowers* distant, on very slender pedicels to c. 2 cm. long, *sepals* 4, the two outer oblong-obovate, concave, c. 5 mm. long, sparsely finely hairy on margins, inner ones larger and broader, c. 6 mm. × 4 mm., finely veined, with sparse short hairs on margin at tip, *petals* 0. *Fruit* ovoid-ellipsoid to almost globose, reaching c. 2 cm. long, acutely beaked, the beak varying in size, sometimes very conspicuous, pericarp thick, hard, not brittle, pale green and smooth-surfaced in life, drying pale reddish brown, rather closely and shallowly wrinkled. **Fig. 11, A–E.**

Malacca: sine loc., *'F.S.' 188*; Merlimau, *Derry 156*; Bukit Sabukor, *Derry 104*; Sungai Udang, *Goodenough 1738.*

Negri Sembilan: Pasir Panjang, *Kep. 4202*; Pengkalan Kempas, *Kep. 4213*; Cape Rachado, *Kep. 71340*; Sungai Menyala F.R., *Kep. 64091.*

Pahang: Sungai Rompin, *Kep. 3230, Fox 5014*; Menchali F.R., *Kep. 29655.*

Johore: Sungai Kayu, *S.F.N. 31990*; Endau to Mersing road, *Kep. 54245*; Renggan F.R., *Kep. 71266, 71270, 71297*; Pulau Tinggi, *Kep. 70936*; Panchor, *Kep. 62814, 62816, 62817*; Mawai, *Corner s.n.*

Singapore: sine loc., *Wallich 4848* (Type), *Maingay K.D. 171*; Changi, *Ridley 4636, 4637, 6085, Baker s.n., Goodenough 142, Hullett 420*; Keranji, *Ridley 260, 1959*; Bukit Mandai, *Ridley 8942*; Seletar, *Ridley 14172*; Bukit Timah, *Ridley 4639, S.F.N. 2030, 34440, 34611, 34697, 36193, 36365, 36500, 38847, Kep. 70532*; Tampenis, *Ridley 4639a*; Chan Chu Kang, *Ridley s.n.*; Gardens Jungle, *Ridley 8940, 13305, Gardens No. 1286*; Pulau Damar Laut, *Sinclair s.n.*

This lowland forest species has been largely confused, by King and Ridley, with *C. floribundum* Hk. f., but it is quite distinct. It is very similar in leaf characters to *C. depressinervosum* nob. and sterile material from the centre of the Peninsula, where the ranges of the two species overlap, is difficult to determine. *C. pulcherrimum*, however, generally has blunter and less acuminate leaves and more pronounced venation below, as well as longer inflorescences and larger fruit.

29. **Calophyllum depressinervosum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 35 m. alta, ramulis gracilibus, in sicco nigro-griseis, junioribus angulosis, glabris, gemmis parvissimis, c. 3 mm. longis, minutissime rufo-tomentosis. *Folia* parva, tenuiter coriacea, plerumque lanceolata vel anguste elliptica, c. 4·5 cm. × 1·5 cm. ad c. 7 cm. × 3 cm., apice plerumque longe acuminata, basi anguste cuneata, nervis lateralibus subtus valde obscuris, supra immersis, tenuibus, distantibus, nervo medio supra prominulo, subtus late et leviter immerso, petiolo breve, gracile. *Racemi* terminales et in axillis foliorum superiorum, c. 2 cm. longi, pauciflori, glabri, pedicellis gracilibus, ad c. 8–10 cm.

longis; *sepala* exteriora obovata, c. 4 mm. × 3 mm., interiora c. 6 mm. × 4 mm.; *petala* 0. *Fructus* globosus, c. 9 mm. diam., in sicco levigatus, fragilis.

A tall *tree*, recorded as up to c. 35 m. in height and nearly 2 m. in girth, without buttresses, bark yellow-orange and greyish-brown, smooth, with diamond-shaped fissures, inner bark pinky red, exudate clear, golden syrup coloured, slightly resinous. *Twigs* slender, usually dark grey when dry, lenticellate, the youngest ones angular, glabrous. *Terminal buds* very small, c. 3 mm. long, rather bluntly pointed and minutely rufous tomentose. *Leaves:* lamina small, thinly coriaceous, not varying much in shape or size, usually lanceolate or narrowly elliptic, from c. 4·5 cm. × 1·5 cm. to c. 7 cm. × 3 cm., usually c. 5·5 cm. × 2·75 cm., apex nearly always rather long acuminate, base narrowly cuneate, venation on lower surface usually very obscure or invisible, usually visible only as very shallow, obscure depressions, on the upper surface more evident, very fine, immersed, usually rather distant (c. 1 mm. apart), curving up, margin of leaf usually slightly revolute, midrib narrow and raised above, depressed below in a shallow, rather wide channel with a central raised ridge, petiole short and slender.

Inflorescences short, racemose, from the upper and terminal leaf-axils, c. 2 cm. long, few-flowered, glabrous, pedicels slender, up to 8–10 mm. long, *sepals* 4, the two outer ones obovate, c. 4 mm. × 3 mm., the inner ones c. 6 mm. × 4 mm., *petals* 0. *Fruit* globose, c. 9 mm. diam., apparently green when ripe, when dry the pericarp smooth, glabrous, brownish, thin and brittle. **Plate XVII. Fig. 11, F, G.**

KEDAH: Gunong Jerai F.R., *Kep. 7745*; Bukit Ladah Acheh, *Kep. 7570*.

PENANG: Moniot's Road, 1,000 ft., *Curtis 830* (TYPE, Holotype in Herb. Singapore).

PERAK: Ulu Kenderong, Grik, *Kep. 11038*; Keledang Saiong F.R., *Kep. 65947*.

SELANGOR: Bangi F.R., *Kep. 14578*; Sungai Buloh F.R., *Kep. 14926*; Kuang, *Kep. 22059, 24858*.

NEGRI SEMBILAN: Kepis F.R., *Kep. 62954*.

PAHANG: Mentakab, *Kep. 7922*.

JOHORE: Kluang F.R., *Kep. 69922*; Mambai F.R., *Kep. 69862*; Mawai, *Corner s.n. 7-10-34*.

A widespread, but as yet not very well-known species of lowland forest. It is very close to *C. pulcherrimum* Wall., but it differs in the short inflorescence, the much smaller fruit without a beak, drying smooth and not wrinkled, and with a thin, papery, brittle pericarp.

In Check List as '*C. depressinerve* ms.'.

30. **Calophyllum nodosum** Vesque, Epharm. 2 (1889) t. 10; et in DC., Monogr. Phan. 2 (1889) 539.—*C. parvifolium* Vesque, DC., Monogr. Phan. (1893) 604, *non* Choisy (1823).—*C. microphyllum* T. Anders. in Hook. f., F.B.I. 1 (1874) 272, *non* Choisy (1861).

A small *tree*. *Twigs* slender, the oldest ones drying dark, the youngest quadrangular, glabrous. *Terminal buds* narrow, bluntly pointed, c. 4 mm. long. *Leaves:* lamina very small, sub-coriaceous, narrowly obovate, apex rounded or broadly and bluntly pointed, sometimes retuse, base much narrowed, reaching c. 4 cm. × 1·5 cm., venation on both surfaces obscure, close and slightly raised, leaf margin thickened, midrib narrowly channelled above, more or less triangular below and often channelled on either side, petiole very short, wrinkled when dry.

Racemes very short, from the upper axils, apparently 2-flowered, glabrous, pedicels c. 5–6 mm. long, *flowers* c. 1 cm. diam., *sepals* 4, suborbicular and subequal, *petals* 0. *Fruit* ellipsoid or globose, to c. 1 cm. long, when dry pale brown to blackish brown, pericarp thin but not brittle, surface rather coarsely wrinkled, smooth between wrinkles. **Fig. 11, H–J.**

MALACCA: Mount Ophir, *Maingay K.D. 165*, *Ridley s.n. Dec. 1898*; Gunong Mering, Mount Ophir, *Ridley 3222*.

The type of this species is *Beccari 2440* from Borneo. It is close to *C. pulcherrimum* Wall. and *C. depressinervosum* nob., but differs in the smaller, differently shaped leaves, the very short inflorescences and the small fruit (c.f. *C. depressinervosum*).

31. **Calophyllum rotundifolium** Ridl. in Journ. F.M.S. Mus. 5 (1915) 29; F.M.P. 1 (1922) 188.

A ?bush or ?small tree. Youngest *twigs* drying pale, 4-angled. *Leaves:* lamina thickly coriaceous, broadly elliptic or orbicular, from c. 2·5 cm. × 2·5 cm. to c. 5 cm. × 4·5 cm., apex broadly and shallowly retuse, base cordate, almost sessile, venation above very obscure and often invisible, usually rather well marked below, curving up to the obscurely thickened margin, upper surface drying warm brown, the lower paler, midrib broad at base, raised a little on both surfaces.

Inflorescences of 1 or 2 terminal, rather large flowers, pedicels c. 1 cm. long, *outer sepals* coriaceous, orbicular, 8 mm. long, *inner sepals* oblanceolate, obtuse, 2 mm. long (fide Ridley), *petals* obovate, rounded, clawed, 1 cm. × 0·9 cm., *stamens* shorter than petals. *Fruit* unknown. **Fig. 11, K, L.**

SELANGOR: Gunong Mengkuang Lebah, *Robinson s.n. January 1913* (TYPE).

Another sheet, without flowers or fruit, collected on the same mountain by *Denny, s.n.*, in 1907, probably belongs here. In this the leaves are much larger than in the type, broadly oblong-elliptic, c. 11 cm. × 6 cm., cordate at base and almost sessile, venation invisible below, fine and slightly raised above, lower surface drying reddish brown, upper surface blackish brown. This collection may represent sapling leaves of *C. rotundifolium*.

Only these collections of *C. rotundifolium* are known. The description of the flowers is taken from the author's original description in which there appears to be a mistake regarding the size of the inner sepals. The type material is too scanty to allow of a flower being detached for dissection. *C. rotundifolium* is distinct in its small, stiff, orbicular leaves and few, large flowers. In foliage it is very like *C. thwaitsii* from Ceylon, but the twigs and inflorescence of this species are quite different.

32. **Calophyllum symingtonianum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 40 m. alta, ramulis glabris, teretibus, in sicco cortice griseo, junioribus angulosis, glabris, nigris, gemmis valde gracilibus, c. 1 cm. longis, minute brunneo-tomentosis. *Folia* parva, subcoriacea, lanceolata vel anguste elliptica, apice plus minusve acuminata, basi abrupte acuta, c. 3·5 cm. × 1·25 cm. ad c. 8 cm. × 3 cm., nervis lateralibus, utrinque plerumque indistinctis, leviter prominulis, approximatis, nonnunquam distinctis, petiolo gracili, ad c. 1 cm. longo. *Flores* ignoti. *Fructus* ellipsoideus vel paullum obovoideus, c. 3 cm. longus.

A tall *tree*, recorded as up to c. 40 m. tall and c. 3 m. in girth, without buttresses, bark fawny-grey to yellow brown, rough, coarsely and distantly fissured, tending to flake near base, inner bark pink, thick, exudate clear, almost colourless, slightly sticky, sapwood very hard and tenacious. *Twigs* glabrous, terete, greyish, the youngest shoots angled, drying dark, glabrous or almost so. *Terminal buds* very slender, pointed, c. 1 cm. long, finely brown tomentose. *Leaves:* lamina small, subcoriaceous, lanceolate or narrowly elliptic, apex more or less acuminate, base rather abruptly narrowed, from c. 3·5 cm. × 1·25 cm., or sometimes smaller to c. 8 cm. × 3 cm., venation on both sides usually rather indistinct, slightly raised and close, sometimes quite distinct and clear cut, midrib rather prominent below, raised above and channelled in the basal half, petiole usually rather long and slender, c. 1 cm. long.

Inflorescences and *flowers* unknown. *Fruit* ellipsoid to very slightly obovoid, c. 3 cm. long, c. 2·5 cm. diam., base of style remaining as a minute apiculus, pericarp thick, not brittle, outer

surface dull dark reddish brown to dark dull purple when dry, glabrous, finely and shallowly wrinkled. **Plate XVIII. Fig. 12, A, B.**

PERAK: Tapah Hills F.R., *Kep. 71911*; Maxwell's Hill, *Kep. 76333.*
PAHANG: Cameron Highlands, *Kep. 12980, 33748, S.F.N. 32633* (TYPE, Holotype in Herb. Singapore), *32904, 32905.*

An imperfectly known species so far recorded from the Cameron Highlands area and Maxwell's Hill.[1] It approaches in some respects *C. fraseri* nob. The rather thin, lanceolate leaves with rather long, slender petioles seem distinctive. The fruit is rather large for a small-leaved species.

33. **Calophyllum cuneatum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 26–28 m. alta, ramulis crassis, teretibus, in sicco cortice pallide griseo, junioribus angulosis, nigris, gemmis brevibus, c. 4–5 mm. longis, acutis, plus minusve ferrugineo-tomentosis. *Folia* coriacea, plerumque anguste elliptica, apice obtuse acuta, basi acuta, plerumque c. 5 cm. × 2·5 cm., nervis lateralibus utrinque prominulis, distinctis, approximatis, petiolo breve. *Inflorescentiae* probabiliter breves, subumbellatae. *Flores* ignoti. *Fructus* globosus, c. 1 cm. diam., in sicco nigro-brunneus, leviter rugosus.

A tall *tree*, recorded as up to c. 26–28 m. in height and c. 2 m. in girth, bark yellow, slightly fissured, exudate whitish. *Twigs* rather stout, terete greyish-fawn, youngest ones angled and drying dark. *Terminal buds* short, pointed, more or less ferrugineous tomentose, c. 4–5 mm. long. *Leaves:* lamina small, coriaceous, usually rather narrowly elliptic, tapered to apex and base, apex usually bluntly acute, usually c. 5 cm. × 2·5 cm., varying from c. 3 cm. × 1·5 cm. to c. 6 cm. × 3 cm., both surfaces drying reddish brown, the upper usually darker, venation close, raised on both surfaces and fairly clear cut and distinct, margin of leaf slightly thickened but not pale, midrib channelled above, raised below, petiole very short, usually less than 7 mm. long.

Inflorescences apparently short and subumbellate, *flowers* unknown. *Fruit* globose, c. 1 cm. diam. or a little more, on pedicels nearly as long, apparently green when ripe, when dry reddish to blackish brown, pericarp not very thick but not brittle or breaking up readily in dried fruit, surface shallowly and coarsely wrinkled, smooth between wrinkles. **Plate XIX. Fig. 12, C, D.**

PAHANG: Cameron Highlands, *S.F.N. 18002, 31232* (TYPE, Holotype in Herb. Singapore), *32594, Kep. 27303, 30957, 36177.*

A rather large tree, apparently common on ridges at Cameron Highlands, and so far known only from that area. It is certainly closely allied to *C. fraseri* nob., but there are differences in the inflorescences, the leaf is shorter with a less acute apex, and the petiole is shorter.

1. I have recently seen several big trees of this species at an elevation of about 500 ft. a.s.l. in west Perangin Forest Reserve, north Kedah (J.W.-S., 2-9-56).

A sheet in Herb. Singapore written up as '*Calophyllum karoense* Beum. msc.' from Siboetan Reserve, Sumatra, ± 1400 m. alt., Neth. Ind. For. Service bb 2770, without flowers or fruit is almost certainly this species.

This species was recognised by Symington prior to the 1939–45 World War, and we have retained his manuscript name of *C. cuneatum* under which he had segregated all collections at Kepong. In Check List as '*C. cuneatum* ms.'.

34. **Calophyllum aureum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor parva, ramulis glabris, gracilibus, junioribus acute tetragonis, gemmis gracilibus, ad c. 8 mm. longis, minute ferrugineo-tomentosis. *Folia* parva, coriacea, late elliptico-oblonga, apice late emarginata vel rotundata, basi acuta, c. 2·5 cm. × 1·5 cm. ad c. 6·5 cm. × 4·5 cm., nervis lateralibus supra distinctis, gracilibus, prominulis, subtus obscuris, petiolo ad c. 1 cm. longo. *Flores* ad c. 2 cm. diam., in paniculas terminales ad c. 6 cm. longas dispositi; *sepala* exteriora dura, oblongo-orbicularia, c. 7 mm. × 6 mm., interiora tenuiora, maiora, c. 9 mm. longa, oblonga-obovata, *petala* 4. *Fructus* maturus ignotus.

A small *tree*, bark smooth, golden coloured. *Twigs* slender, glabrous, youngest ones sharply 4-angled. *Terminal buds* slender, finely rusty tomentose, up to c. 8 mm. long. *Leaves:* lamina small, coriaceous, usually rather broadly elliptic-oblong, from c. 2·5 cm. × 1·5 cm. to c. 6·5 cm. × 4·5 cm., apex apparently always broadly and shallowly retuse or rounded, never pointed, base narrowed, upper surface drying rather pale greyish brown, lower surface a darker warm brown, venation above close, fine, rather sharply cut, obscure and very little raised below, midrib narrowly channelled above, raised below, petiole 1 cm or less long.

Inflorescences terminal, paniculate, glabrous, one or more together, to c. 6 m. long, peduncle to c. 3 cm. long, lower pedicels to nearly 1 cm. long, *flowers* rather large, c. 2 cm. diam. when expanded, *outer sepals* tough but not very thick, with thickened midrib at base, oblong-orbicular, c. 7 mm. × 6 mm., *inner sepals* larger and thinner, c. 9 mm. long, oblong-obovate, *petals* 4, similar to inner sepals. No ripe *fruit* seen, young fruit globular, drying dark coloured and not wrinkled. **Plate XX. Fig. 12, E, F, J.**

PERAK: top of Gunong Batu Puteh, *Scortechini 377b*; Gunong Korbu, *Kep. 32118*.

SELANGOR: Fraser Hill, *Kep. 11468*.

PAHANG: Gunong Beramban, Cameron Highlands, *Kep. 31007* (TYPE, Holotype in Herb. Singapore); *Batten-Pooll s.n.*

A montane species of ridge tops in mossy forest and closely allied to *C. aureo-brunnescens* which follows. It also resembles *C. hosei* Ridl., described from Borneo, but is sufficiently distinct.

This species was first recognised by Symington prior to the 1939–45 World War, and we have retained his manuscript name of *C. aureum* under which he had segregated all collections at Kepong.

35. **Calophyllum aureo-brunnescens** Henderson & Wyatt-Smith, **sp. nov.**

Arbor parva, ad c. 4 m. alta, ramulis gracilibus, cortice nigro, junioribus angulatis, gemmis valde gracilibus, c. 6–7 mm. longis, minutissime tomentosis. *Folia* parva, coriacea, plus minusve elliptico-lanceolata, c. 3·5 cm. × 1·5 cm. ad c. 7 cm. × 3·5 cm., apice obtuse acuta, basi acuta, nervis lateralibus supra obscuris, immersis, subtus prominulis, indistinctis, petiolo ad c. 1 cm. longo. *Paniculae* terminales, ad c. 8 cm. longae, pedicellis ad c. 1·5 cm. longis; *flores* c. 2 cm. lati; *sepala* exteriora dura, oblongo-orbicularia, c. 7 mm. × 5 mm., interiora-tenuiora, oblongiora, c. 9 mm. longa, *petala* 4. *Fructus* maturus ignotus.

A small *tree,* reaching about 4 m. tall. *Twigs* slender, dark coloured, the youngest ones angled. *Terminal buds* very slender, pointed, c. 6–7 mm. long, very minutely tomentose. *Leaves:* lamina small, coriaceous, usually elliptic-lanceolate, from c. 3·5 cm. × 1·5 cm. to c. 7 cm. × 3·5 cm., apex nearly always bluntly acute, base tapered, upper surface drying dark brown, lower paler, venation above rather obscure, usually incised, not clear cut, usually raised below but not clear cut, midrib slightly channelled above, raised below, petiole usually 1 cm. or less long.

Inflorescences terminal, paniculate, usually 3 together, up to c. 8 cm. long but usually less, pedicels reaching c. 1·5 cm. long, *flowers* rather large, c. 2 cm. across when expanded, *outer sepals* tough and wrinkled, thickened along the centre line, oblong-orbicular, concave in bud, boat-shaped after anthesis, c. 7 mm. × 5 mm., *inner sepals* thinner and more oblong, c. 9 mm. long, *petals* 4, similar to the inner sepals. No well developed *fruit* seen. **Plate XXI. Fig. 12, G, H.**

PAHANG: Padang Luas, Gunong Tahan, *F.M.S. Mus. 12240*; Gunong Tahan, *Ridley 16015, Wray & Robinson 5340, 5395,* at 5,500 ft. *S.F.N. 7855* (TYPE, Holotype in Herb. Singapore); Gunong Ulu Kechau at 6,000 ft., *Kep. 42911*; Kluang Terbang, Gunong Benom, *Barnes s.n.* (this collection appears to be a connecting link between this species and *C. aureum*).

A species closely allied to *C. aureum*, but easily sorted from it in the herbarium because of its leaves, which are always more or less acute, not rounded or retuse, and which dry darker above than below. The inflorescences and flowers of the two species are similar, but the flowers of *C. aureo-brunnescens* have tougher outer sepals.

C. aureo-brunnescens is a plant of open places on high mountains and does not appear to occur in ridge-top, mossy forest.

36. **Calophyllum intramarginale** Henderson & Wyatt-Smith, **sp. nov.**

Arbor parva, ad c. 10 m. alta, ramulis in sicco nigro-brunneis, gemmis angustis, c. 7 mm. longis, sparse ferrugineo-pubescentibus. *Folia* parva, valde coriacea, plus minusve obovata, c. 3 cm. × 1·5 cm. ad c. 6·5 cm. × 3·5 cm., apice rotundata ut retusa, basi late cuneata, nervis lateralibus utrinque distinctis, in venam intramarginalem obscuram confluentibus, petiolo breve. *Paniculae* terminales vel in axillis foliorum superiorum, pseudo-umbellatae, c. 4–5 cm. longae, pedicellis c. 1 cm. ad c. 2·5 cm. longis; *flores* 2–6, glabri; *sepala* 4, orbicularia, c. 5–6 mm. diam., exteriora ad marginem minute ciliata; *petala* 2, sepala similiter. *Fructus* subglobosus, leviter acutus, in sicco fere niger, in vivo viridis, c. 2·5 cm. × 2 cm., pedicello 2·5 cm. longo.

A small *tree*, recorded up to c. 10 m. tall and c. 45 cm. in girth, without buttresses, bark greyish brown and with shallow longitudinal fissures, inner bark dark, exudate yellow. Youngest *twigs* rather slender and angular, almost or quite glabrous, blackish brown and striate when dry, older twigs stouter, dark grey to pale grey. *Terminal buds* very slender, pointed, c. 7 mm. long, sparsely ferrugineous pubescent. *Leaves:* lamina small, thickly and stiffly coriaceous, more or less obovate, tip rounded or broadly and shallowly retuse, base broadly cuneate, from c. 3 cm. × 1·5 cm. to c. 6·5 cm. × 3·5 cm., drying dull reddish brown, midrib narrow on upper surface, channelled at base and slightly raised or almost flat in upper 2/3, rather broad below and raised, venation usually rather distinct on both sides, rather close, raised but not sharply cut, anastomosing in a not very conspicuous but usually quite definite intramarginal vein, petiole short, usually less than 1 cm. long.

Inflorescences from the terminal and upper leaf-axils, pseudo-umbellate, usually 4–5 cm. long, peduncle rather stout, glabrous, minutely bracteate at apex, pedicels glabrous, rather stout, variable in length, from less than 1 cm. to c. 2·5 cm. long, *flowers* 2–6 from the apex of the peduncle, buds glabrous, globose, c. 6 mm. diam., *sepals* 4, orbicular, concave, c. 5–6 mm. diam., rather thin, the outer ones minutely ciliate on the margins, *petals* 2, similar to sepals. *Fruit* subglobose, hard, slightly pointed, dark mauvey black when dry, green in life, c. 2·5 cm. × 2 cm., pedicel 2·5 cm. long. **Plate XXII. Fig. 13, A, B.**

TRENGGANU: Gunong Padang, at 4,000 ft., *S.F.N. 31900* (TYPE, Holotype in Herb. Singapore); Rasau-Kerteh F.R., at 1,000 ft., *Kep. 67753*.

This species, of which only two collections have been made, closely resembles *C. inophylloide* var. *singapurense*, but it has smaller leaves with an intramarginal vein, shorter inflorescences in which all the flowers arise from the apex of the peduncle, and it is montane.

37. **Calophyllum blumutense** Henderson & Wyatt-Smith, **sp. nov.**

Frutex vel *arbor parva* ad c. 11–12 m. alta, ramulis gracilibus, teretibus, cortice nitido, nigro vel rubro-brunneo, junioribus angulosis, pallidibus, glabris, gemmis parvis gracilibus, 4–5 mm. longis, minutissime tomentosis. *Folia* coriacea, margine incrassata, plerumque elliptica, c. 4 cm. × 2 cm. ad c. 10·5 cm. × 5 cm., apice late et obtuse acuta vel breviter et abrupte acuminata, basi acuta, nervis lateralibus subtus distantibus, immersis, supra prominulis, petiolo breve. *Racemi* in axillis foliorum superiorum, graciles, pauciflori, ad c. 6 cm. longi, pedicellis gracilibus, ad c. 1·5 cm. longis; *sepala* exteriora dura, late oblonga, glabra, c. 4·5 mm. longa, interiora exterioribus tenuiora, oblonga, c. 7 mm. longa; *petala* 3. *Fructus* ellipsoideus, c. 1·5 cm. longus, in vivo flavus, siccitate nitidus.

A *shrub*, or *small tree*, recorded as up to 11–12 m. tall. *Twigs* rather slender, terete and smooth, blackish or reddish brown when dry, the youngest ones angled, pale, glabrous. *Terminal buds* small, narrow and pointed, very minutely tomentose, c. 4–5 mm. long. *Leaves:* lamina small. coriaceous, usually elliptic, with a slight tendency to be narrowly obovate, from c. 4 cm. × 2 cm. to c. 10·5 cm. × 5 cm., apex broadly and bluntly acute, or rather abruptly and shortly and bluntly acuminate, base narrowed, venation below coarse and incised, raised above and faintly clear cut, rather distant, midrib usually raised above and narrow and rounded, broader below, raised but not prominent, leaf margin thickened and pale, both surfaces drying brownish, the lower paler, upper surface sometimes drying grey, petiole short, usually considerably less than 1 cm. long.

Racemes from the upper leaf-axils, slender, laxly few-flowered, glabrous, reaching c. 6 cm. long, pedicels slender, to c. 1·5 cm. long, *outer sepals* tough, rather small, broadly oblong, c. 4·5 mm. long, glabrous, *inner sepals* thinner, oblong, c. 7 mm. long, *petals* apparently 3, similar to inner sepals, *ovary* depressed globose. *Fruit* ellipsoid, c. 1·5 cm. long, yellow when ripe, pericarp pale reddish brown when dry, thin and brittle, breaking up easily, smooth, hardly or not wrinkled. **Plate XXIII. Fig. 13, E, F, G.**

JOHORE: Gunong Belumut, c. 3,300 ft., *Kep. 5880* (TYPE, Holotype in Herb. Singapore), *S.F.N. 10658*, *10737*; Gunong Panti, 1,600 ft., *S.F.N. 18098*.

A small tree of ridgetops, very local in occurrence. It is very closely allied to *C. floribundum*, having in common with it the pale leaf margin and shape of lamina, but it is distinguished from that species by the different venation, which is more distant on the upper surface. We have compared our material with *C. fragrans* Ridl., a species described from Borneo, but believe that it differs.

38. **Calophyllum fraseri** Henderson & Wyatt-Smith, **sp. nov.**

Affinis *C. cuneato* Henderson & Wyatt-Smith, sed foliis longioribus, lanceolatis vel lanceolato-oblongis, ad c. 8 cm. × 3 cm., petiolis longioribus differt. *Racemi* breves, numerosi, ad 2–3 cm. longi; *flores* glabri, c. 8–9 mm. lati; *sepala* 4, *petala* 0. *Fructus* ellipsoideus, apiculatus, c. 2 cm. longus, in sicco niger.

A tall *tree*, recorded as reaching c. 33 m. in height and c. 1 m. in girth, without buttresses, bark grey, smooth with vertical lenticellate ridging c. 1 cm. apart and some horizontal lines, inner bark c. 7·5 mm. thick, pink, fibrous, and with a slight, pale yellow, non-sticky, varnish-like exudate, very close to *C. cuneatum* in twigs, buds and leaves, except that the *leaves* are longer, lanceolate or lanceolate-oblong or ovate-lanceolate, up to c. 8 cm. × 3 cm., young leaves larger, with the same type of venation as in *C. cuneatum,* and drying a similar colour, but with longer petioles, usually 1 cm. or a little longer.

Racemes short, dense, numerous, rising from short, stout side shoots, up to c. 2–3 cm. long, *flowers* glabrous, c. 8–9 mm. diam., *sepals* 4, nearly equal, broadly oblong rounded to nearly orbicular, reflexed after anthesis, *petals* 0, stamen filaments rather short. *Fruit* ellipsoid, shortly and finely beaked with the remains of the style, c. 2 cm. long, 1·3 cm. diam., pericarp black, hard and finely wrinkled when dry, pedicel stout, c. 2 cm. long. **Plates XXIV, XXV. Fig. 13, C, D, H, J.**

TRENGGANU: Gunong Padang at 4,000 ft. *S.F.N. 31878.*

PAHANG: Fraser Hill, *S.F.N. 11282* (TYPE, Holotype in Herb. Singapore), *Kep. 28955*, at 4,200 ft., *76052*, *F.M.S. Mus. 11576*, *Burkill & Holttum s.n.* (?sapling).

The Gunong Padang collection is placed here with a little doubt. Originally we had intended to keep it separate. If it is distinct it is obviously closely related to *C. fraseri,* but its leaves are more coriaceous.

39. **Calophyllum costulatum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor, ramulis crassis, cortice levigato, flavo, junioribus angulosis, rufo-tomentosis, gemmis anguste turbinatibus, pallide et minute tomentosis. *Folia* parva, rigide coriacea, marginibus crassis, plerumque oblongo-obovata, nonnunquam oblonga vel oblongo-elliptica, ad c. 4 cm. × 2 cm., apice plerumque retusa, basi plerumque late cuneata, nervis lateralibus tenuibus, approximatis, subtus obscuris, supra prominulis, nervo medio subtus prominente, sparse tomentoso, supra ad basin immerso, tomentoso, petiolo tomentoso, breve, ad c. 5 mm. longo. *Racemi* ex axillis foliorum superiorum orientes, pyramidiformes, pauciflori, ad c. 6 cm. longi, pedunculo 2–3 cm. longo, rubro-tomentoso, rachide pedicellisque pallide rubro-tomentosis, pedicellis inferioribus c. 1·5 cm. longis, superioribus brevioribus; *sepala* exteriora dura, oblongo-orbicularia, concava, c. 5 mm. × 4 mm., extus dense et pallide tomentosa, interiora tenuiora, obovato-orbicularia, c. 6 mm. longa et lata, glabra, marginibus apice exceptis; *petala* 0. *Fructus* ignotus.

A 'medium-sized' *tree*. *Twigs* rather stout, yellowish, smooth, slightly pale hoary, youngest shoots angular and reddish tomentose. *Terminal buds* narrowly conical, pointed, pale hoary tomentose. *Leaves:* lamina small, stiffly coriaceous, usually oblong-obovate, sometimes oblong or oblong-elliptic, up to c. 4 cm. × 2 cm., apex usually retuse, base usually broadly cuneate, upper surface drying dark reddish brown, lower much paler, venation very close and fine, often very obscure below, more evident above, raised and fairly clear cut, midrib very prominent and rounded below, sparsely tomentose especially at base, slender on the upper surface, sunk in a narrow channel at the base and raised elsewhere, tomentose, leaf margin thickened and recurved, petiole short, usually 5 mm. or less long, tomentose.

Racemes from the upper leaf-axils, pyramidal, laxly flowered, up to c. 6 cm. long, peduncle 2–3 cm. long, reddish tomentose, rachis and pedicels with pale, reddish brown, close tomentum, *flowers* spreading, in distant pairs or whorls, pedicels to c. 1·5 cm. long, the upper ones shorter, expanded flowers a little over 1 cm. diam., *outer sepals* tough, oblong-orbicular, concave, c. 5 mm. × 4 mm., densely pale tomentose outside, *inner sepals* thinner, obovate-orbicular, c. 6 mm. long and broad, glabrous except for margins at tip, *petals* 0. *Fruit* unknown. **Plate XXVI. Fig. 13, K.**

JOHORE: Tanjong Bunga, *Ridley 6332 June 1894* (TYPE, Holotype in Herb. Singapore).

A distinct species, of which one collection only has been made. Its very stiff, small, more or less obovate leaves, tomentose on the midrib, and its rather long inflorescences with very tomentose outer sepals distinguish it. *Calophyllum enervosum* nob. closely resembles this species in leaf shape and size.

40. **Calophyllum pisiferum** Planch. & Tri., Ann. Sci. Nat. 4, 15 (1861) 266; Ridl., F.M.P. 1 (1922) 184.

A ?bush or ?small tree. *Twigs* more or less persistently tomentose, the youngest ones angled and densely reddish tomentose, the older ones grey, with reticulately cracked bark. *Terminal* buds narrow, conical, short, pointed, densely red tomentose, c. 4 mm. long. *Leaves:* lamina small, subcoriaceous, usually more or less elliptic, sometimes narrowly so, or ovate-elliptic, apex rounded or very bluntly acute, base rounded or more or less cuneate, from c. 3 cm. × 1·5 cm. to c. 7 cm. × 3·5 cm., sometimes narrower in proportion to length, venation usually close and raised on both surfaces, but not very sharp or clear cut, curving upwards, often obscure or very obscure below, midrib finely channelled above, more or less raised below but not prominent, petiole very short.

Racemes axillary, numerous, finely tomentose, short, reaching c. 2 cm. long, densely flowered, pedicels short, *flowers* small, c. 1 cm. diam., *sepals* 4, thin, glabrous, the outer two oblong-orbicular, c. 4–5 mm. long, the inner ones slightly longer and broader, *petals* 0. *Fruit* small, globose, 7–8 mm. diam., creamy-yellow in life (*fide* Ridley), pale reddish brown to dark reddish brown when dry, pericarp thin and brittle, usually coarsely and shallowly wrinkled, sometimes hardly wrinkled, smooth between wrinkles. **Fig. 13, L.**

PERAK: sine loc., *Scortechini s.n., 255.*

MALACCA: sine loc., *Griffith s.n.* (TYPE), *Maingay K.D. 166, Hervey s.n., unknown collector 125, 1332.*

Ridley in his Flora of the Malay Peninsula states that this is a plant of swamps, but there is no confirmation of this on the labels of the material listed. A little-known but distinct species, distinguished by its persistently tomentose twigs, its small, usually broadly elliptic leaves, and its short, dense inflorescences. It does not appear to have been collected for over fifty years.

King in the Materials reduces this species to *C. retusum* Wall., but the two are quite distinct.

41. **Calophyllum rupicolum** Ridl. in Trans. Linn. Soc. 3, 4 (1893) 278; F.M.P. 1 (1922) 182.

A much branched *bush* to c. 2 m. tall, without buttresses and with slight, cloudy, canary-yellow exudate. Young *twigs* strongly 4–angled, pale brown when dry. *Terminal buds* narrow and pointed, minutely reddish tomentose, 4–5 mm. long. *Leaves:* lamina small, subcoriaceous, narrowly lanceolate, tapered to the subacuminate apex and to the base, from c. 3 cm. × 0·5 cm. to c. 11 cm. × 2·5 cm., but generally c. 4 cm. long, both surfaces rather dull brown when dry, the lower paler, venation very obscure below, ridged and furrowed, similar but slightly more evident above, midrib raised on both surfaces, petiole short.

Racemes short and compact, few-flowered, mostly from the upper leaf-axils, bracteate at base but the bracts dropping early, rachis tomentose, pedicels slender, more or less tomentose, *flowers* small, *outer sepals* broadly ovate acute, c. 3 mm. × 2·5 mm., slightly hoary pubescent outside, *inner sepals* narrowly obovate, c. 4·5 mm. long, *petals* 0. *Fruit* small, ellipsoid-globose to globose, 8–9 mm. long, on a slender pedicel 1 cm. long, minutely apiculate, orange coloured in life (*fide* Ridley) or green, drying pale reddish

brown or bluish mauve, pericarp thin and brittle, breaking up in herbarium material, smooth, not or very slightly wrinkled. **Fig. 13, O, P.**

KELANTAN: Kuala Rek, *S.F.N. 10175.*

PAHANG: Tahan river, *Ridley 2636* (TYPE), *Corner s.n. 7-9-37*; Kuala Teku, *Seimund 568*; Sungai Teku, *Seimund 234, S.F.N. 8094*; Kuala Tahan, *Seimund 48, 700, 701*; Sungai Tembeling, *Kep. 71944, 71945.*

Found only on the banks of rocky streams and rivers east of the main range. Distinct in its bushy habit, small, lanceolate leaves with obscure venation, and short inflorescences.

C. rupicolum variety. The following collections (which at first we described as a separate, numbered, but unnamed species) are included under *C. rupicolum* for the present, although not yet described as a variety, for, although the leaves are very like those of *C. rupicolum* they are very much broader in proportion to their length and the collections are all from medium-sized or small trees, not from small bushes. However, broader leaves are to be expected from larger trees such as those growing in wet but non-water-flowing sites or whose leaves are above the influence of fast running water. Further field studies will have to be made and if this variation is confirmed an amended description of *C. rupicolum* will be necessary.

A small or medium-sized *tree* to c. 15 m. tall and 1·5 m. in girth, without buttresses, bark greyish to brownish, slightly rough, with small, vertical, shallow fissures, outer bark thin, corky, inner bark pinkish fawn, fairly thick, exudate fairly copious appearing in large, milky-yellow drops, sticky. Youngest *twigs* strongly quadrangular, dark reddish brown, almost or quite glabrous, older ones terete, smooth, paler. *Terminal buds* small, narrowly conical, pointed, very finely reddish tomentose, c. 3 mm. long. *Leaves:* lamina small, thinly coriaceous, elliptic or oblong-elliptic, sometimes oblanceolate, apex usually shortly acuminate, base rather narrowly cuneate or acuminate, c. 4 cm. × 1·5 cm. to c. 12 cm. × 3·5 cm., upper surface drying dark reddish brown, lower much paler and warm brown, venation usually quite evident on both surfaces, well spaced and incised below, with a slightly raised vein centrally between the sunk ones, upper surface similar, midrib more or less channelled in lower half above, usually pale, prominent below and more or less keeled, petiole short, usually less than 5 mm. long.

Racemes terminal and from the upper leaf-axils, c. 3–4 cm. long, slender, glabrous except for the very short peduncle, pedicels in distant decussate pairs, usually 3 pairs and a terminal one,

flowers unknown. *Fruit* ovoid-globose, apiculate, c. 1 cm. long, 8 mm. diam., glabrous, pale yellow-green in life, coarsely wrinkled and bluish-mauve when dry, smooth between wrinkles, pedicel 1 cm. long. **Plate XXVII. Fig. 13, M, N.**

TRENGGANU: Bukit Bauk F.R., *Kep. 76091.*

JOHORE: Mawai, *S.F.N. 34706, 34747*; Kangka Sedili Ketchil, *Corner s.n. 17-6-34.*

In fresh-water swamp forest or in water by riverside. Characterised by the angular young twigs, the oblanceolate leaf drying dark reddish brown above, and the curious, *Dipterocarpus*-like, but faint and distant, obtusely ridged venation.

42. **Calophyllum gracillimum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 13 m. alta, ramulis teretibus, gracilibus, pallidibus, interdum fere albis, junioribus rubro-tomentosis, glabrescentibus, gemmis brevibus, cylindraceis, rubro-tomentosis, 3–4 mm. longis. *Folia* parva, subcoriacea, plus minusve elliptica vel elliptico-lanceolata, apice late acuta vel acuminata, basi acuta vel cuneata, c. 2·5 cm. × 1 cm. ad c. 7 cm. × 3 cm., nervis lateralibus subtus immersis, inter se distantibus, obscuris, supra tenuissimis, indistinctis, immersis vel leviter prominulis, petiolo breve, gracili, plus minusve tomentoso. *Flores* terminales, solitarii, vel in axillares 2–3 dispositi, subsessiles vel pedicellati, 1·4 cm. diam.; *sepala* 4, extus ferrugineo-tomentosa; *petala* 2, anguste oblonga, glabra, marginibus sparse pilosis exceptis. *Fructus* globosus, c. 1·2 cm. diam., breviter pedicellatus.

A small *tree*, reaching c. 13 m. in height and c. 1·5 m. in girth at breast height, without buttresses, bark pale greeny-yellow grey or biscuit coloured, very smooth, with small lenticels, thin, exudate white, scanty. *Twigs* slender, terete, pale, sometimes nearly white, youngest ones fugaciously reddish hairy. *Terminal buds* short, cylindrical, blunt, reddish hairy, 3–4 mm. long. *Leaves:* lamina small, subcoriaceous, more or less elliptic, or elliptic-lanceolate, from c. 2·5 cm. × 1 cm. to c. 7 cm. × 3 cm., apex broadly and bluntly acute or acuminate, base narrowed, sometimes broadly cuneate, leaf margin slightly thickened, venation below very obscure, incised, midrib slightly fugaciously reddish hairy, very slender and raised above, raised below, sometimes channelled on either side, petiole short, slender, more or less tomentose; young leaves pale red.

Flowers faintly scented, solitary and terminal, or 1 or 2 in each axil, occasionally the inflorescence consisting of a short 3-flowered cyme, flowers nearly sessile or pedicel c. 5 mm. long, red tomentose, expanded flower, c. 1·4 cm. diam., *outer sepals* ovate-oblong, subacute, concave, thick textured, densely red tomentose externally, c. 5·5 mm. × 4–5 mm., *inner sepals* c. 7 mm. × 4·5 mm., also thick and red tomentose externally, reflexed in open flower, *petals* 2, narrow, more or less oblong, but tapered slightly to each

end, c. 6 mm. × 2 mm., but variable in size and apparently also in shape, slightly red tomentose on margins, *stamen* filaments joined at base in phalanges, longest ones to c. 5 mm., *ovary* globose, c. 2 mm. diam. *Fruit* globose, c. 1·2 cm. diam., on a pedicel c. 5–6 mm. long, when dry red, the surface dull and very minutely wrinkled, pericarp thick, not brittle. **Plate XXVIII. Fig. 13, Q, R, S.**

PAHANG: Bukit Balai, Rompin, *Kep. 2715* (TYPE, Holotype in Herb. Kepong); Ulu Perah, *Kep. 11209*.

JOHORE: Panti F.R., *Kep. 70320*; Mawai-Jemaluang road, *S.F.N. 28998*; Renggam F.R., *Kep. 71267*.

An imperfectly known species of lowland forest, sometimes in the drier parts of swamp forest, but very distinct in the very few or solitary, almost sessile flowers, the smooth biscuit coloured bark, the pale twigs and the small leaves with indistinct venation. The flowers appear to be distinctive in having both inner and outer sepals tomentose on the outer surfaces and in the narrow petals. It resembles *Calophyllum sp. No. 45* in the pale twigs and small leaves but is distinct in its venation

43. **Calophyllum biflorum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 33 m. alta, ramulis glabris, gracilibus, in sicco nigris vel nigro-brunneis, junioribus plus minusve angulosis, rufo-tomentosis sed mox glabris, gemmis parvis, obtusis, dense rufo-tomentosis. *Folia* parva, subcoriacea vel coriacea, plerumque oblonga vel oblonga-elliptica, nonnunquam plus minusve obovata, ad c. 6 cm. × 2·5 cm., apice plerumque retusa vel rotundata, basi cuneata, nervis lateralibus utrinque prominulis, petiolo ad c. 1 cm. longo, transverse striato. *Racemi* terminales, vel ex axillis foliorum superiorum, ad c. 2–3 cm. longi, plerumque 2-flori, rachi pedicellisque gracilibus, pedicellis ad c. 1·2–1·3 cm. longis; *sepala* 4, exteriora orbicularia, concava, glabra, margine membranacea et breviter tomentosa, c. 4 mm. diam., interiora obovato-orbicularia, c. 4 mm. longa, venis conspicuis; *petala* 0. *Fructus* globosus, c. 2 cm. longus et 1·75 cm. diam., pedicello c. 1·2 cm. longo.

A *tree* up to c. 33 m. tall and c. 1·5 m. in girth, without buttresses, bark biscuit-coloured or yellow-green to pale grey with white splashes, smooth with slight obscure cracking when young, frequently with abundant longitudinal lenticels, to coarsely fissured with fine fissures between when old, inner bark pink or deep red, soft, thick, exudate white to cream-coloured, very sticky, hardening to a clear resin and darkening slightly on exposure. *Twigs* rather slender, terete, usually dark coloured, sometimes pale greyish to greyish brown, the youngest ones somewhat angled, with quickly deciduous red tomentum. *Terminal buds* small, 3–4 mm. long, blunt, densely red tomentose. *Leaves:* lamina small, subcoriaceous to coriaceous, usually oblong or oblong-elliptic, with a tendency to be obovate, apex rounded, retuse, or rarely

broadly and obtusely acute, base cuneate, up to c. 6 cm × 2·5 cm., occasionally larger, usually c. 4·5 cm. × 2·25 cm., venation on both surfaces raised, fine and clear cut, more so on the lower surface, rather distant, midrib narrowly channelled in lower half above, then narrowly raised, prominent below and often with a narrow median channel, or keeled, young leaves finely and sparsely mealy tomentose on midrib above and on base of midrib below, petiole to 1 cm. long or a little more, transversely wrinkled.

Inflorescences small and few-flowered, terminal or from the upper few leaf-axils, at first apparently short with a short peduncle which is red tomentose like the terminal buds, and with narrow, red tomentose, deciduous bracts and short pedicels, but quickly lengthening, the peduncles then slender and reaching c. 1 cm. long, eventually glabrous, the pedicels slender, glabrous, to c. 1·2–1·3 cm. long, each inflorescence usually 2–flowered, at least when mature, mature flower buds c. 4 mm. × 3·5 m., *sepals* 4, the two outer ones orbicular, concave, longitudinally veined, c. 4 mm. diam., margins thin and finely hairy, the inner ones orbicular-obovate, about the same size as the outers, strongly veined, almost ribbed when dry, *petals* 0, *stamen* filaments short, *ovary* glabrous, broadly ovoid, style rather stout, stigma large, flat. *Fruit* globular, c. 2 cm. long and 1·75 cm. across, pale whitish green in life, pale grey brown and coarsely wrinkled when dry, pericarp thin, brittle, pedicel c. 1·2 cm. long. **Plate XXIX. Fig. 14, A–G.**

JOHORE: Gunong Arong F.R., *Kep. 35963* (TYPE, Holotype in Herb. Kepong), *71311*, *76288*; Jemaluang F.R., *Kep. 69978*, *69982*; Kluang F.R., *Kep. 71288*, *76296*; Panti F.R., *Kep. 73055*; Renggam F.R., *Kep. 69904*, *71268*; Endau to Mersing road, *Kep. 76281*, *76283*.

SINGAPORE: Sungai Hantu, opposite Pulau Serimbun, *S.F.N. 39532*.

A lowland forest species distinguished by its small leaves with clear cut venation and short, few-flowered inflorescences. In some respects it resembles *C. globuliferum* Ridl. from Borneo, but this species is quite glabrous and has longer inflorescences with more flowers.

44. **Calophyllum sp.**

A *tree* up to c. 15 m., without buttresses, occasionally with crowded stilt roots and loop roots (*Corner, s.n. 30-4-34*), bark smooth to cracking and shallow rugose fissured, greyish fuscous to brownish olive, lenticellate, inner bark pink, exudate yellow, watery. *Twigs* slender, glabrous, pale greyish to olive brown, youngest ones brown, angled. *Terminal buds* small, rusty-red tomentose, c. 3–4 mm. long. *Leaves:* lamina small to medium-sized, subcoriaceous, glabrous, obovate, apex rounded, base narrowed,

c. 5–8 cm. long by 2–3 cm. wide, venation slightly raised on both faces fine, rather distant, rather obscure on lower face, midrib raised on both surfaces, finely and distinctly sharply cut on upper face, petiole short, slender, c. 6 mm. long, strongly channelled, lamina with distinctly visible (on upper surface) but scarcely raised marginal rim. *Inflorescences*, *flowers* and *fruits* unknown. **Plate XXX. Fig. 15, A.**

JOHORE: Sungai Semandan, Jason Bay, *Corner s.n. 30-4-34* and *16-6-34*.

These two sterile collections resemble in foliage rather closely *C. biflorum*, but the apex of the lamina is rounded, the midrib is sharply raised on the upper surface, a distinct marginal rim to the lamina is present and the exudate is yellow. Corner records on one field label that this 'species' occurs frequently in dry forest on a sand bank; the other collection, also by Corner and from the same vicinity, was made from a tree growing in wet swampy forest.

45. **Calophyllum sp.**

A *tree* reaching c. 23 m. tall or more, c. 1 m. girth at breast height, bark greeny-yellow, grey, smooth, with a few small lenticels, or slightly longitudinally fissured, a pale yellow layer under outer bark, inner bark pink, exudate yellow, sparse, slightly sticky. *Twigs* slender, terete, glabrous, the youngest ones slightly angled, smooth, greyish white or very pale yellowish white. *Terminal buds* very narrow and slender, very minutely reddish tomentose, c. 4–5 mm. long. *Leaves:* lamina small to medium-sized, rather thin and chartaceous when dry, usually narrowly oblong-elliptic or elliptic-lanceolate, sometimes elliptic, apex with a rather long, narrow acumen rounded at tip, base cuneate, usually c. 7 cm. × 2·5 cm., sometimes shorter and broader, sometimes reaching c. 9 cm. × 3 cm., sapling leaves rather larger and lacking the acumen, venation very fine and close, raised and sharply cut on both surfaces, midrib narrowly raised above and very finely channelled, rather prominent below and keeled, petiole slender, drying dark, usually c. 4–6 mm. long.

Inflorescence apparently axillary, *flowers* unknown, *fruit* globose, c. 1·5 cm. diam., quite smooth and red brown when dry, with crustaceous thin brittle pericarp, breaking up easily. **Plate XXXI. Fig. 14, H, J.**

KEDAH: Sungkap F.R., *Kep. 59624*; Enggang F.R., *Kep. 73776*.
NEGRI SEMBILAN: Sungai Menyala F.R., *Kep. 64079*, *64665*.
PAHANG: Gali, Raub, *S.F.N. 16220* (collected as a medicinal plant); Sg. Terengan, King George V National Park, *Kep. 71956*.
JOHORE: Kluang, *S.F.N. 9424*.

A distinct group, of which, however, the material known is scanty and imperfect. It is distinguished by the very slender, very pale, almost white twigs, the small, thin leaves with fine close distinct venation, a long acumen, and the round, crustaceous fruit (see note under *C. gracillimum*). It is close to *C. floribundum*.

46. **Calophyllum enervosum** Henderson & Wyatt-Smith, **sp. nov.**

Arbor ad c. 33 m. alta, ramis robustis, cortice nitido, novellis quadrangularis nigris, gemmis plus minusve ovoideis, tenuiter tomentosis, c. 2–3 mm. longis, nonnunquam ad c. 5 mm. *Folia* valde coriacea, elliptico-spathulata vel anguste obovata, apice rotundata vel late subacuta, basi cuneata, c. 3 cm. × 1 cm. ad c. 6·5 cm. × 3 cm., nervis lateralibus valde obscuris, petiolo c. 5–9 cm. longo. *Inflorescentiæ* (immatura) terminales et in axillis foliorum superiorum, cum bracteis decussatis ovatis subacutis ferrugineo-tomentosis instructis; *flores* singulatim in axillis bracteorum dispositi; *sepala* exteriora ovata, concava, extus dense ferrugineo-tomentosa, c. 4 mm. longa, interiora glabra; *petala* ?4, exteriora sepala interiora similiter, interiora angustiora. *Fructus* ignotus.

A *tree* reaching c. 33 m. in height and c. 2·5 m. in girth, without buttresses, bark greenish-orange to biscuit coloured, smooth to rough, very finely cracking, outer bark thin, inner bark thick, exudate clear turning cloudy pale brown, appearing in droplets, drying quickly. *Twigs* stout, glabrous, the older ones terete, rather smooth and pale, dirty white or slightly tinged yellow, youngest shoots 4-angled, almost black. *Terminal buds* more or less ovoid, subacute, broad, 2–3 mm. or up to c. 5 mm. long. *Leaves:* lamina small, rigidly coriaceous, rather narrowly obovate or elliptic-spathulate, apex rounded or very broadly subacute, base narrowed, margin distinctly raised, from c. 3 cm. × 1 cm. to c. 6·5 cm. × 3 cm., venation very obscure or invisible, sometimes just visible above, almost always invisible below, or traces of it visible under a lens, midrib slightly channelled at base above and often blackish, slender and slightly raised in upper half of lamina, prominent and longitudinally ridged below, both surfaces drying warm red brown, the upper somewhat polished, the lower dull, petiole to c. 9 mm. long, stout, drying black; in weathered leaves picked up from the forest floor both surfaces dry pale brown with a distinct pale margin and the petiole and midrib below dry pale yellow.

Inflorescences terminal and from most of the 3 or 4 upper leaf-axils, with ovate, subacute, reddish tomentose bracts c. 6 mm. long in close decussate pairs, each subtending one flower (but only very young inflorescences seen); *flowers* in very young bud, *outer sepals* ovate, concave, c. 4 mm. long, densely reddish tomentose externally, *inner sepals* about the same shape and size, glabrous,

petals ?4, the two outer like the inner sepals, the two inner somewhat narrower (but the two outer sepals here described may be bracts, and there may be, therefore, 4 sepals and 2 petals). *Fruit* unknown. **Plate XXXII. Fig. 15, B, C.**

JOHORE: Jemaluang F.R., *Kep. 71894* (TYPE, Holotype in Herb. Kepong), *72907*.

A distinct species known only from these two collections from lowland forest in Jemaluang Forest Reserve. It is distinguished by the very coriaceous, elliptic-spathulate leaves with very obscure venation and the pale yellow grey twigs. It is close to *C. costulatum* in leaf shape and size, but the leaf is glabrous and the petiole is stouter and slightly winged by the tapering base of the lamina.

LIST OF COLLECTORS' NUMBERS

The number of the species or group is in brackets after the collector's number

ALVINS—983 (25).

ANDERSON—144 (27).

BECCARI—2440 (30).

BURN-MURDOCH—330 (27).

CANTLEY—174 (24); 464 (18); 2676 (11).

CURTIS—133 (11); 523 (18); 830 (29); 1153 *p.p.* (2); 1153 *p.p.* (4); 1154 (2); 1425 (18); 1426 (5); 1543 (4); 1562 (11); 3411 (18).

DERRY—104 (28); 119 (17); 126 (17); 151 (17); 156 (28); 393 (27); 443 (27); 514 (27); 515 (1).

'F.S.'—188 (28).

FEDERATED MALAY STATES MUSEUMS (F.M.S. MUS.). 11576 (38); 12240 (35).

FOREST DEPARTMENT, KUCHING—00379 (1).

FOREST RESEARCH INSTITUTE, KEPONG (Kep.*)—20 (5); 0273 (12); 0312 (6); 0338 (6); 384 (12); 0557 (6); 0569 (11); 609 (4); 628 (17); 658 (21); 0821 (11); 0829 (18); 0882 (18); 0883 (4); 904 (11); 1014 (11); 1151 (21); 1185 (14); 1266 (18); 1267 (21); 1592 (6); 1831 (18); 1953 (6); 1980 (18); 2063 (6); 2264 (25); 2583 (6); 2591 (11); 2615 (6); 2623 (6); 2647 (18); 2649 (6); 2712 (27); 2714 (25); 2715 (42); 2735 (20); 2743 (20); 2810 (11); 2853 (18); 3071 (12); 3139 (14); 3230 (28); 3426 (11); 3628 (1); 3705 (11); 3706

* All Malayan Forest Department collections belong to one series; they were formerly cited in literature with the prefix CF (Conservator of Forests), but in this paper the whole series has been cited with the prefix Kep.

(14); 3737 (11); 4179 (11); 4183 (1); 4198 (7); 4202 (28); 4213 (28); 4563 (5); 4735 (20); 4740 (6); 5185 (18); 5314 (6); 5315 (21); 5458 (5); 5464 (4); 5473 (1); 5680 (11); 5870 (18); 5880 (37); 6305 (5); 6538 (17); 6789 (11); 7570 (29); 7683 (27); 7730 (11); 7745 (29); 7922 (29); 8116 (11); 8132 (11); ?9839 (12); 9962 (18); 10013 (4); 10016 (11); 10097 (11); 10368 (14); 10470 (6); 10652 (18); 10667 (14); 10903 (6); 10974 (6); 11038 (29); 11209 (42); 11468 (34); 11645 (6); 11970 (5); 12022 (5); 12854 (27); 12980 (32); 13281 (12); 13341 (18); 13342 (18); 13343 (18); 13627 (19); 13958 (6); 14578 (29); 14579 (6); 14768 (6); 14769 (6); 14770 (6); 14771 (6); 14772 (6); 14774 (5); 14775 (5); 14776 (5); 14777 (5); 14782 (6); 14904 (6); 14926 (29); 15258 (6); 15266 (18); 15452 (27); 15463 (18); 15638 (27); 15734 (11); 15748 (16); 16441 (6); 16462 (6); 16872 (6); 17293 (20); 17316 (21); 17357 (11); 17925 (27); 18032 (18); 18278 (14); 18503 (25); 18505 (6); 18702 (6); 18718 (18); 20687 (18); 21259 (6); 21958 (6); 21962 (6); 21975 (5); 21988 (6); 21992 (6); 22059 (29); 23230 (26); 23353 (5); 23381 (21); 23389 (27); 23651 (18); 23664 (6); 23666 (18); 23713 (6); 23817 (21); 24703 (12); 24858 (29); 24931 (5); 25211 (6); 25253 (6); 25257 (6); 25271 (6); 25322 (6); 26454 (6); 26455 (6); 27154 (19); 27192 (19); 27302 (19); 27303 (33); 28497 (14); 28915 (14); 28918 (4); 28955 (38); 29640 (16); 29645 (11); 29655 (28); 29997 (27); 30691 (18); 30957 (33); 30960 (19); 31007 (34); 31043 (12); 31602 (20); 31611 (20); 31651 (11); 32118 (34); 32204 (6); 32324 (18); 32330 (18); 32394 (14); 32515 (18); 32750 (18); 33001 (11); 33634 (2); 33748 (32); 34015 (19); 34263 (18); 35850 (17); 35963 (43); 36177 (33); 37883 (12); 38157 (18); 38176 (18); 38507 (6); 38512 (6); 39464 (12); 39466 (14); 39900 (6); 40164 (27); 40213 (25); 40216 (7); 40218 (27); 40220 (27); 40226 (27); 40338 (14); 40466 (5); 40529 (14); 42270 (11); 42820 (18); 42911 (35); 43188 (4); 43570 (15); 43589 (11); 43627 (14); 43665 (6); 43692 (26); 44163 (25); 45675 (22); 45689 (22); 45946 (1); 46205 (26); 46207 (26); 47869 (14); 50819 (27); 51575 (12);

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FORBES—322a (9).

FOX—5014 (28).

GARDENS No. (Botanic Gardens, Singapore)—1286 (28); 1668 (6); 1691 (27); 1962 (1).

GOODENOUGH—142 (28); 1738 (28); 1791 (4).

GRIFFITH—882 (9).

HOLMBERG—819 (6).

HULLETT—420 (28).

KUNSTLER (King's collector)—3378 (27); 3477 (5); 3737 (5); 4979 (11); 5225 (18); 5328 (17); 5366 (27); 5374 (17); 5403 (27); 5420 (4); 5446 (18); 5459 (17); 6724 (5); 6877 (15); 7243 (27); 7285 (27); 7311 (15); 7704 (4); 7763 (27); 7785 (12); 8112 (12); 8497 (18); 8597 (18); 10885 (25); 10910 (25); 10929 (25).

LAKE & KELSALL—4054 (14).

MAINGAY—K.D. 165 (30); K.D. 166 (40); K.D. 167 (16); K.D. 169 (27); K.D. 170 (27); K.D. 171 (28); K.D. 173 (25); 1645 (4).

NUR—1668 (6).

RIDLEY—260 (28); 384 (12); 1955 (17); 1956 (24); 1959 (24); 1959 (28); 2636 (41); 3222 (30); 3223 (25); 4185 (17); 4636 (28); 4637 (28); 4639 (28); 4639a (28); 4799 (24); 4800 (27); 4923 (27); 5071 (1); 5747 (24); 5751 (27); 6085 (28); 6196 (6); 6332 (39); 6333 (2); 6934 (24); 6935 (27); 6941 (13); 8414 (24); 8415 (24); 8940 (28); 8942 (28); 10842 (24); 11958 (27); 13305 (28); 14119 (27); 14172 (28); 15446 (14); 15540 (27); 16015 (35).

SCORTECHINI—253a (15); 255 (40); 377b (34); 682 (27); 994 (11); 2044 (4); 2078 (4).

SEIMUND—48 (41); 234 (41); 568 (41); 700 (41); 701 (41).

SINGAPORE FIELD NUMBER (S.F.N.)—236 (24); 1379 (25); 1753 (17); 2010 (1); 2030 (28); 3695 (4); 5176 (27); 7803 (2); 7855 (35); 8020 (3); 8094 (41); 9424 (45); 10175 (41); 10658 (37); 10723 (10); 10737 (37); 11282 (38); 11463 (19); 11655 (25); 14872 (27); 15358 (27); 16220 (45); 18002 (33); 18003 (19); 18098 (37); 18530 (11); 19743 (25); 20601 (3); 23653 (19); 24501 (27); 24976 (27); 26047 (26); 26159 (26); 28196 (24); 28197 (24); 28198 (24); 28199 (24); 28200 (24); 28599 (27); 28659 (27); 28662 (13); 28998 (42); 29050 (26); 29969 (10); 30321 (7); 30565 (7); 30865 (18); 30877 (17); 30977 (1); 30987 (2); ?31076 (3); 31232 (33); 31878 (38); 31900 (36); 31990 (28); 32240 (14); 32274 (8); 32324 (18); 32518 (13); 32594 (33); 32633 (32); 32904 (32); 32905 (32); 33143 (27); 33506 (18); 33561 (2); 34087 (26); 34440 (28); 34546 (2); 34611 (28); 34632 (2); 34644 (13); 34646 (24); 34647 (1); 34650 (27); 34697 (28); 34706 (41 var.); 34719 (17); 34728 (20); 34747 (41 var.); 34748 (27); 34751 (27); 34752 (17); 34911 (1); 35797 (24); 35943 (24); 36193 (28); 36254 (27); 36255 (27); 36365 (28); 36449 (6); 36476 (2); 36500 (28); 36637

(26); 36806 (16); 36891 (4); 37108 (14); 37387 (27); ?37715 (5); 38846 (1); 38847 (28); 38848 (27); 39252 (26); 39433 (27); 39434 (18); 39435 (24); 39441 (24); 39442 (24); 39443 (24); 39444 (18); 39445 (27); 39451 (2); ?39452 (1); 39532 (43); ?40226 (1); 40266 (24); 40267 (27).

Uknown Collector—125 (40); 463 (26); 1332 (40).

Wallich—4843 *p.p.* (2); 4846 (26); 4848 (28); 4849a (18).

Wray & Robinson—5340 (35); 5344 (3); 5395 (35).

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(Species in **heavy type** are described in this paper, those in ordinary type are referred to in the text, and those in *italics* are synonyms. Unnamed species, which have been described in the text under a number, e.g. *Calophyllum sp. No. 10*, are included at the end of this index.)

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C. rotundifolium *Ridl.*, **337.**
C. rubiginosum *Hend. & W.-S.*, 304, 305, **308.**
C. rufigemmatum, 305.
C. rupicolum *Ridl.*, 285, 312, **346.**
C. sclerophyllum *Vesque*, 287, 316, **324.**
C. scriblitifolium *Hend. & W.-S.*, **326.**
C. soulattri *Burm.*, **319,** 322.
C. spectabile Willd., 319, 320.
C. subhorizontale *Hend. & W.-S.*, **325.**
C. subluridum, 325.
C. subsessile King, 318, 319.
C. symingtonianum *Hend. & W.-S.*, **338.**
C. tahanense *Hend. & W.-S.*, **305,** 313.
C. tenuivenium *Hend. & W.-S.*, **311.**
C. thwaitsii, 338.
C. venustum King, 332.
C. wallichianum *Pl. & Tr.*, **303,** 306, 307, 310.
C. wallichianum King, 308.
C. sp. No. 10, 313.
C. sp. No. 23, 327.
C. sp. No. 36, 311.
C. sp. No. 44, 350.
C. sp. No. 45, 349, **351.**
C. sp. No. 51, 328.
C. sp. No. 55, 322.
C. sp. No. 56, 322.

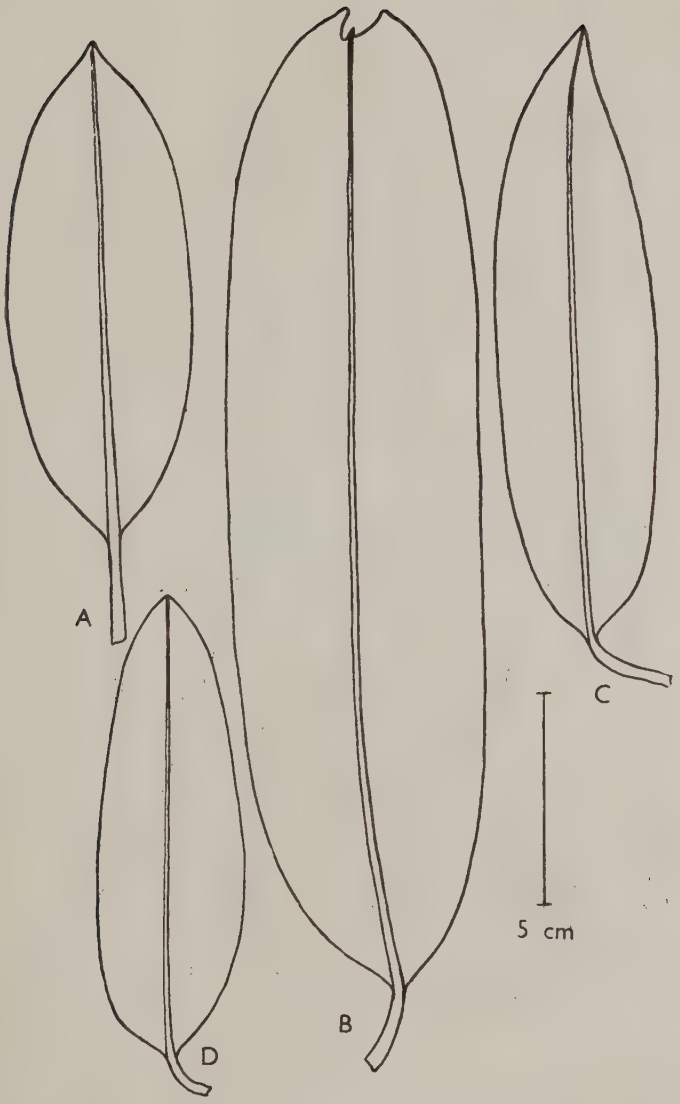

Fig. 1. A, B, *C. incrassatum.* C, D, *C. wallichianum.*

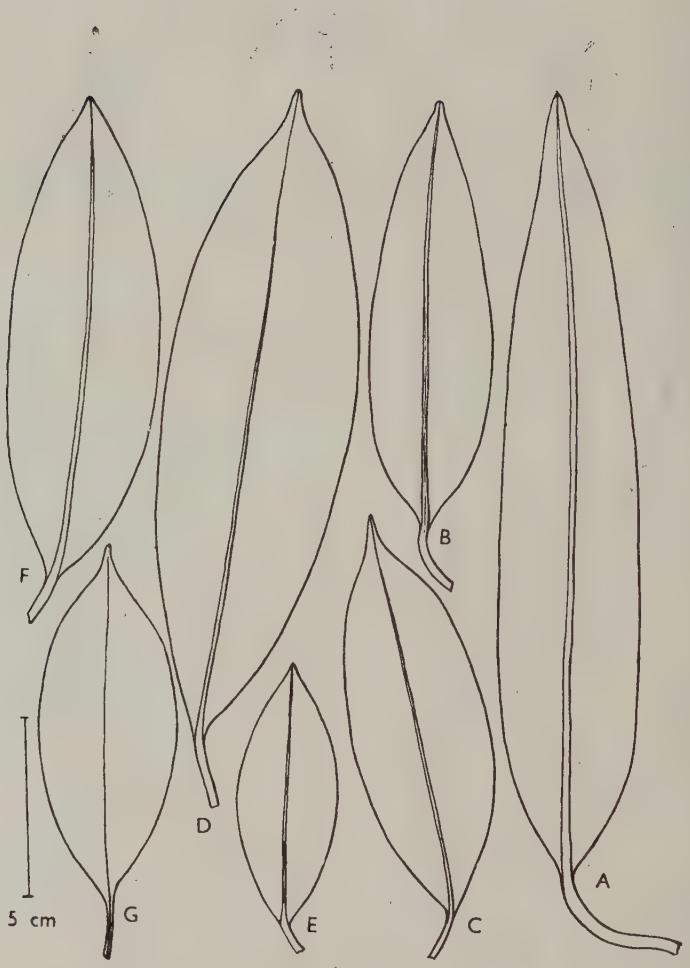

Fig. 2. A, B, *C. tahanense*. C, D, *C. canum*. E, F, *C. molle*. G, *C. rubiginosum*.

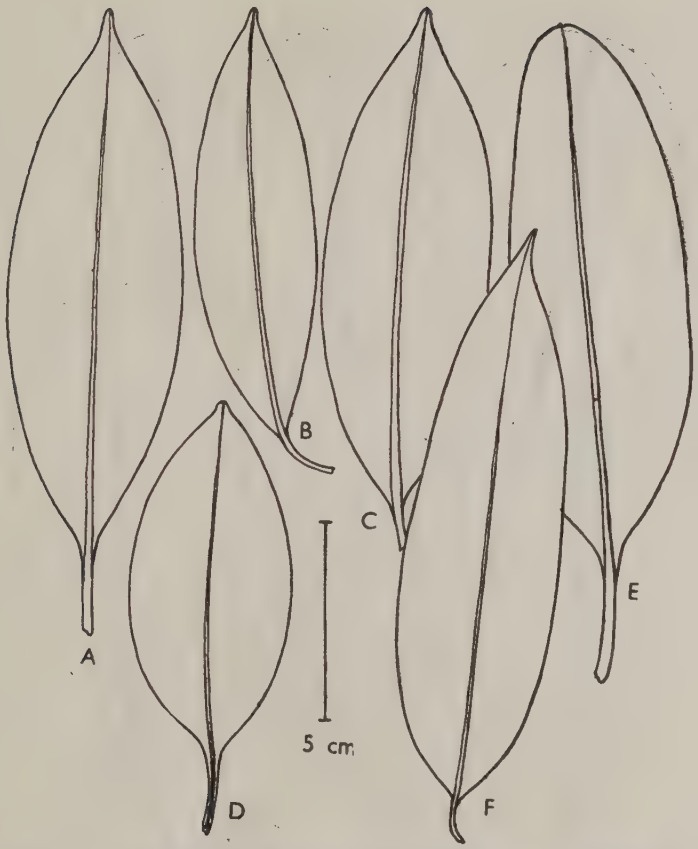

Fig. 3. A, *C. rubiginosum.* B, C, *C. flavo-ramulum.* D, *C. tenuivenium.* E, *C. sp. No. 10.* F, *C. curtisii* (see also Fig. 6, E–H).

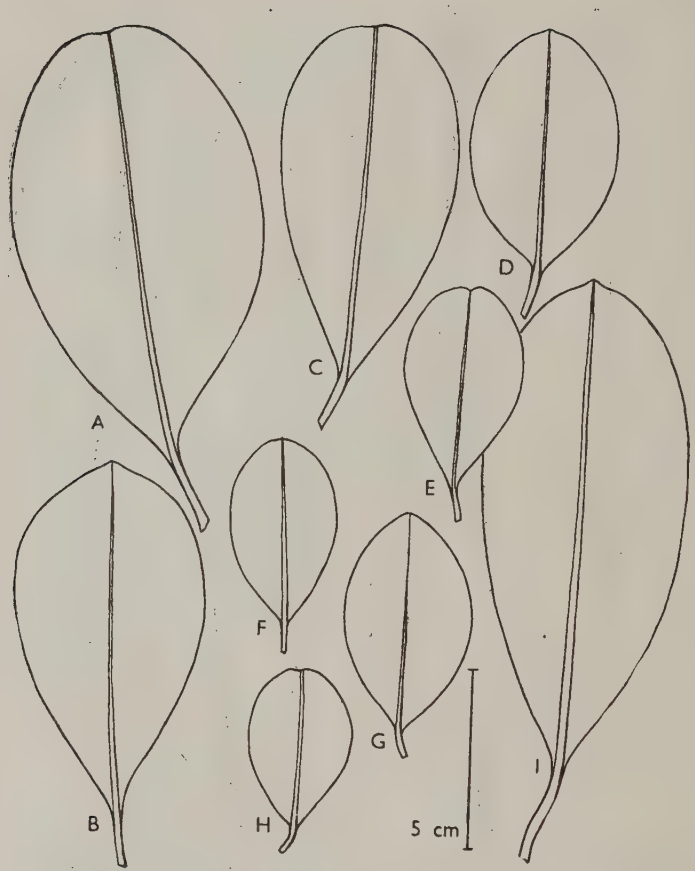

Fig. 4. A, B, *C. inophyllum*. C, *C. inophylloide*. D–H, *C. inophylloide* var. *singapurense*. I, *C. macrocarpum*.

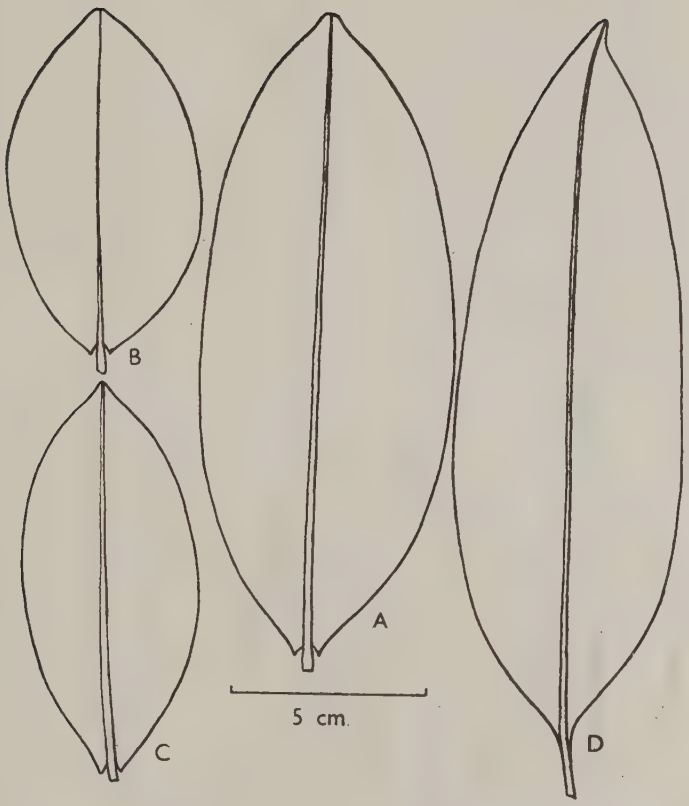

Fig. 5. A–C, *C. javanicum*. D, *C. soulattri*.

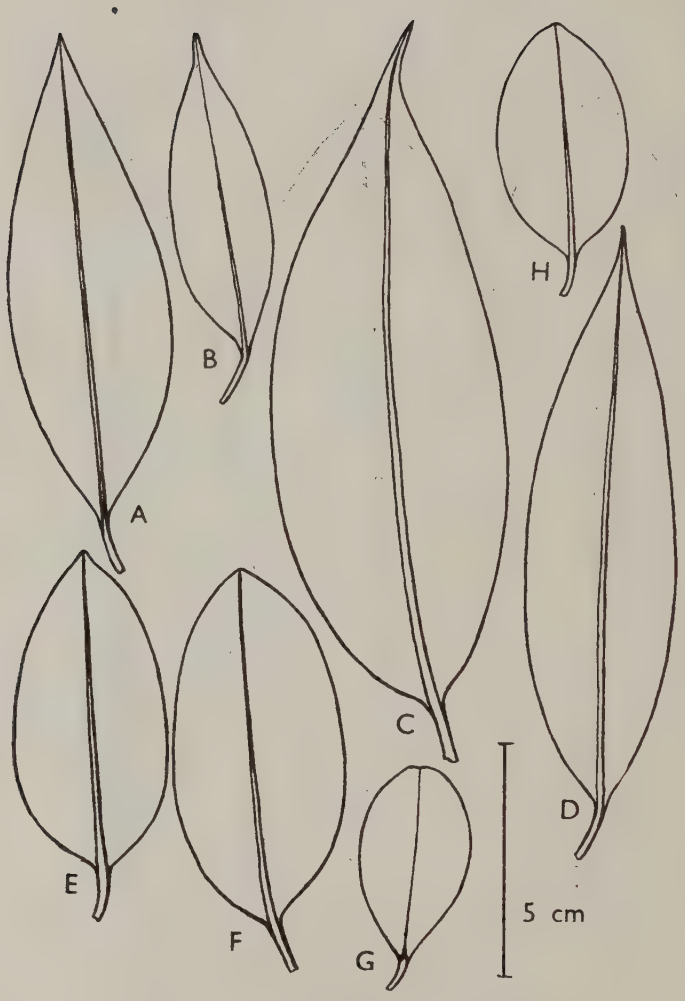

Fig. 6. A–D, *C. kunstleri*. E–H, *C. curtisii*.

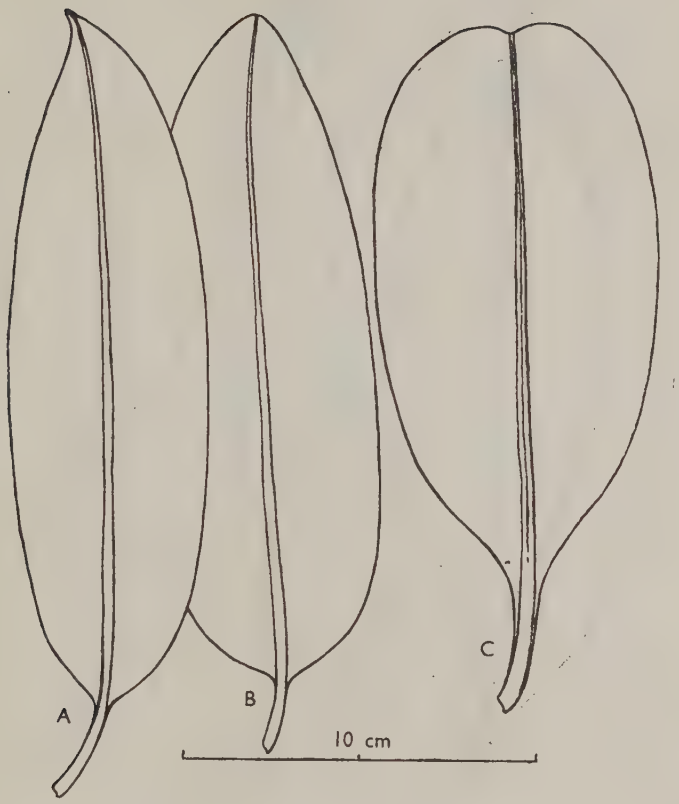

Fig. 7. A, B, *C. coriaceum*. C, *C. sclerophyllum*.

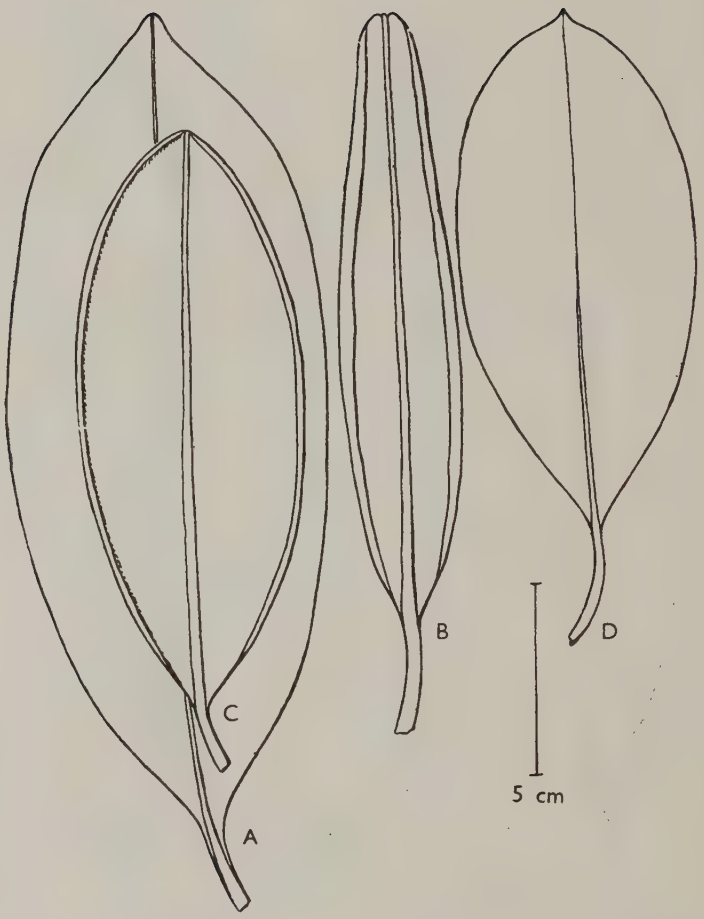

Fig. 8. A, *C. subhorizontale*. B, C, *C. scriblitifolium*. D, *C. sp. No. 23*.

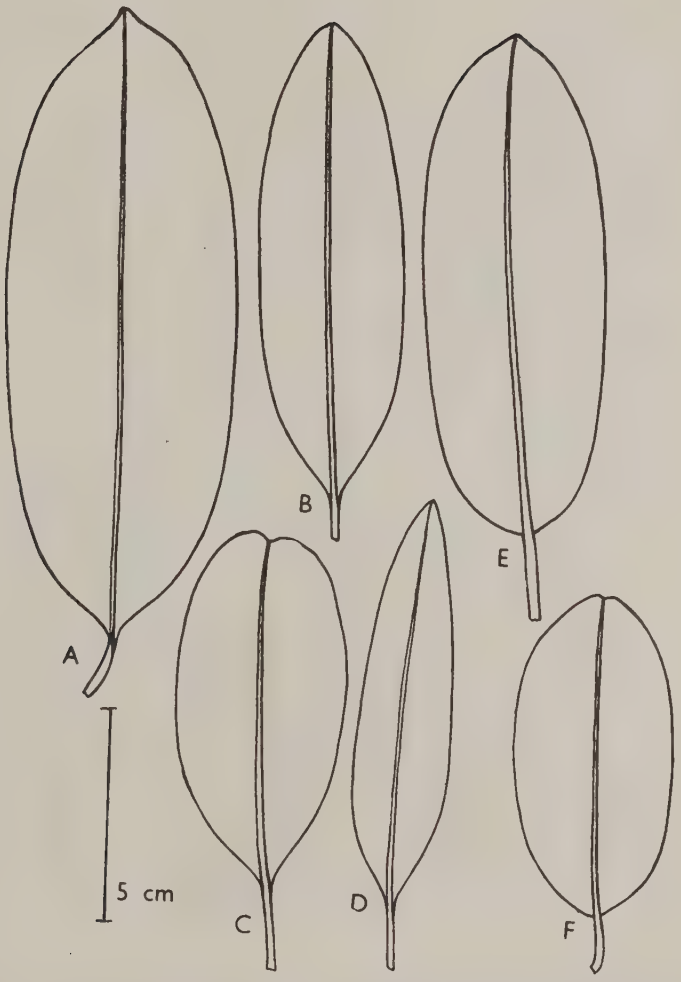

Fig. 9. A–C, *C. ferrugineum*. D, *C. ferrugineum* var. *neriifolium*. E, F, *C. retusum*.

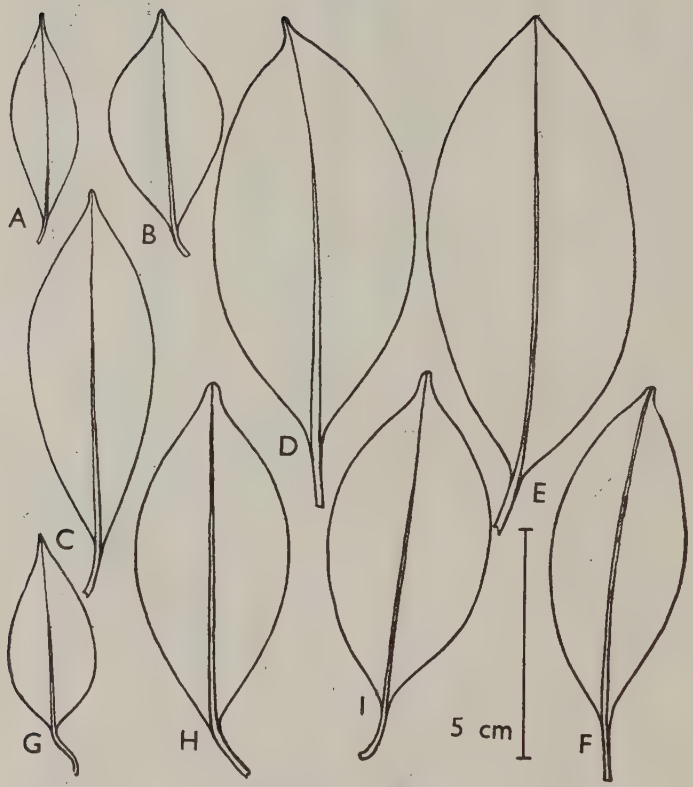

Fig. 10. A–I, *C. floribundum.*

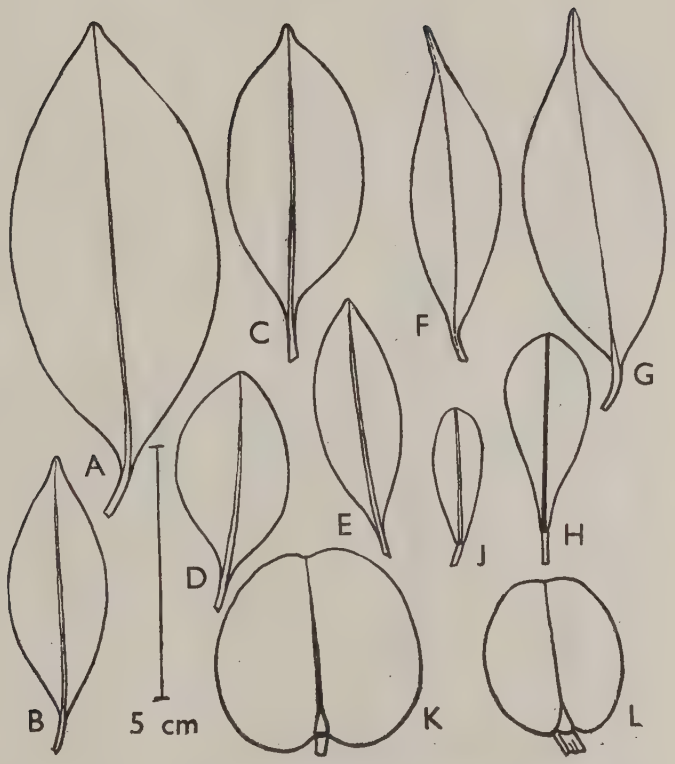

Fig. 11. A–E, *C. pulcherrimum.* F, G, *C. depressinervosum.* H, J, *C. nodosum.* K, L, *C. rotundifolium.*

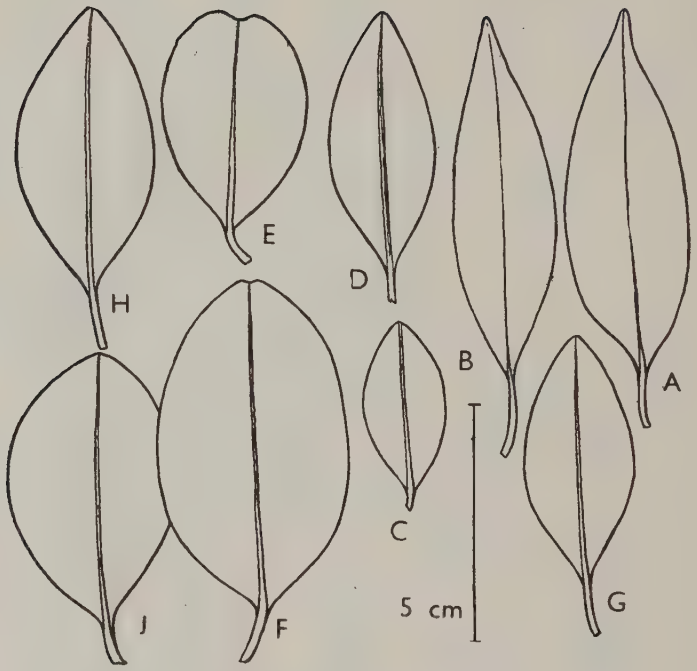

Fig. 12. A, B, *C. symingtonianum.* C, D, *C. cuneatum.* E, F, J, *C. aureum.* G, H, *C. aureo-brunnescens.*

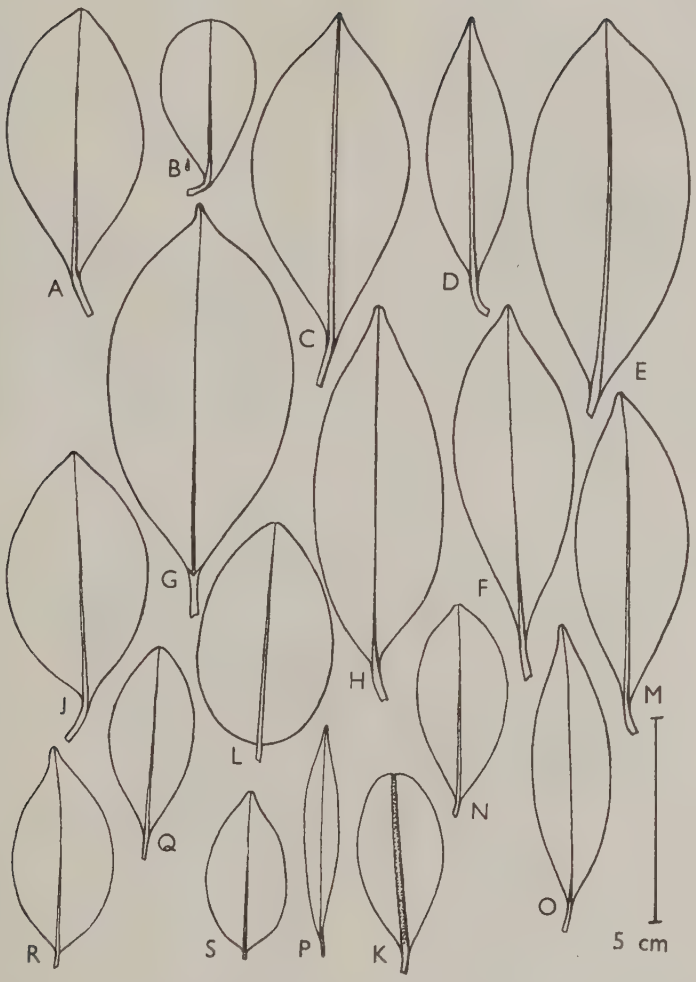

Fig. 13. A, B, *C. intramarginale*. C, D, H, J, *C. fraseri*. E–G, *C. blumutense*. K, *C. costulatum*. L, *C. pisiferum*. M, N, *C. rupicolum* var. O, P, *C. rupicolum*. Q–S, *C. gracillimum*.

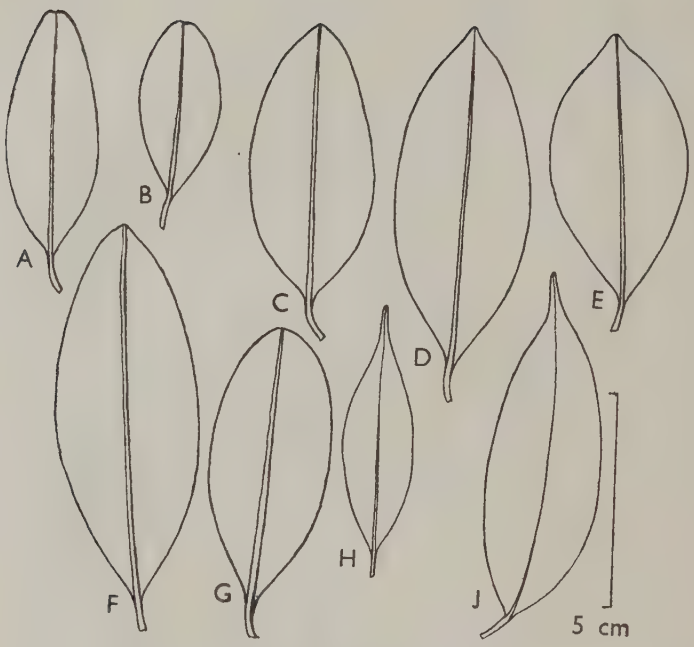

Fig. 14. A–G, *C. biflorum*. H, J, *C. sp. No. 45*.

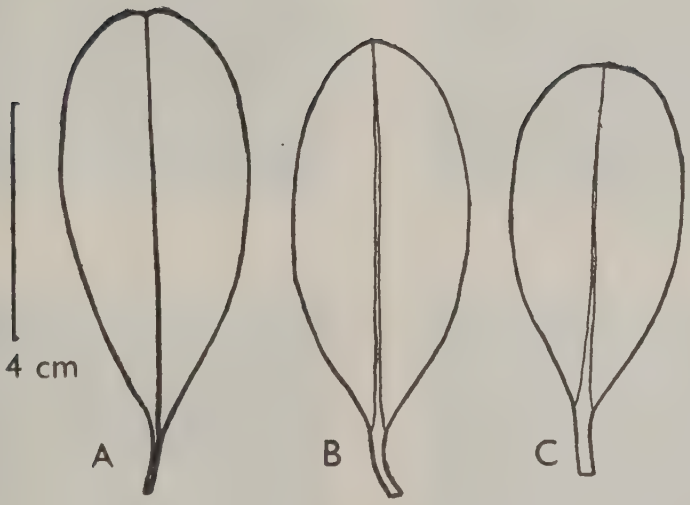

Fig. 15, A, *C. sp. No. 44.* B, C, *C. enervosum.*

A. *C. inophyllum*

B. *C. wallichianum*

C. *C. flavo-ramulum*

D. *C. sp. No. 23*

Plate I. Bark. Photographs A, B and C show the typical boat-shaped fissured bark which is so characteristic of many species of *Calophyllum*.

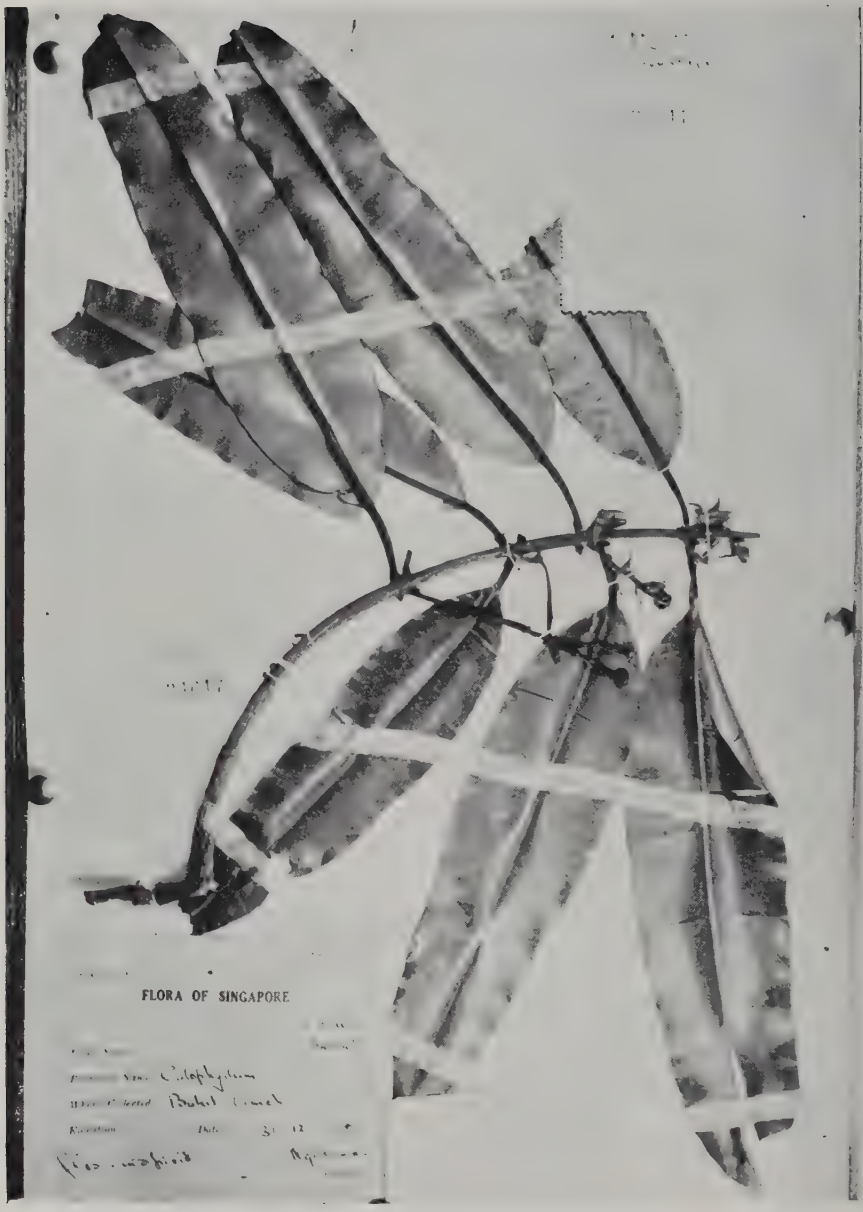

Plate II. Calophyllum incrassatum *Hend. & W.-S.* (S.F.N. 34647, type collection).

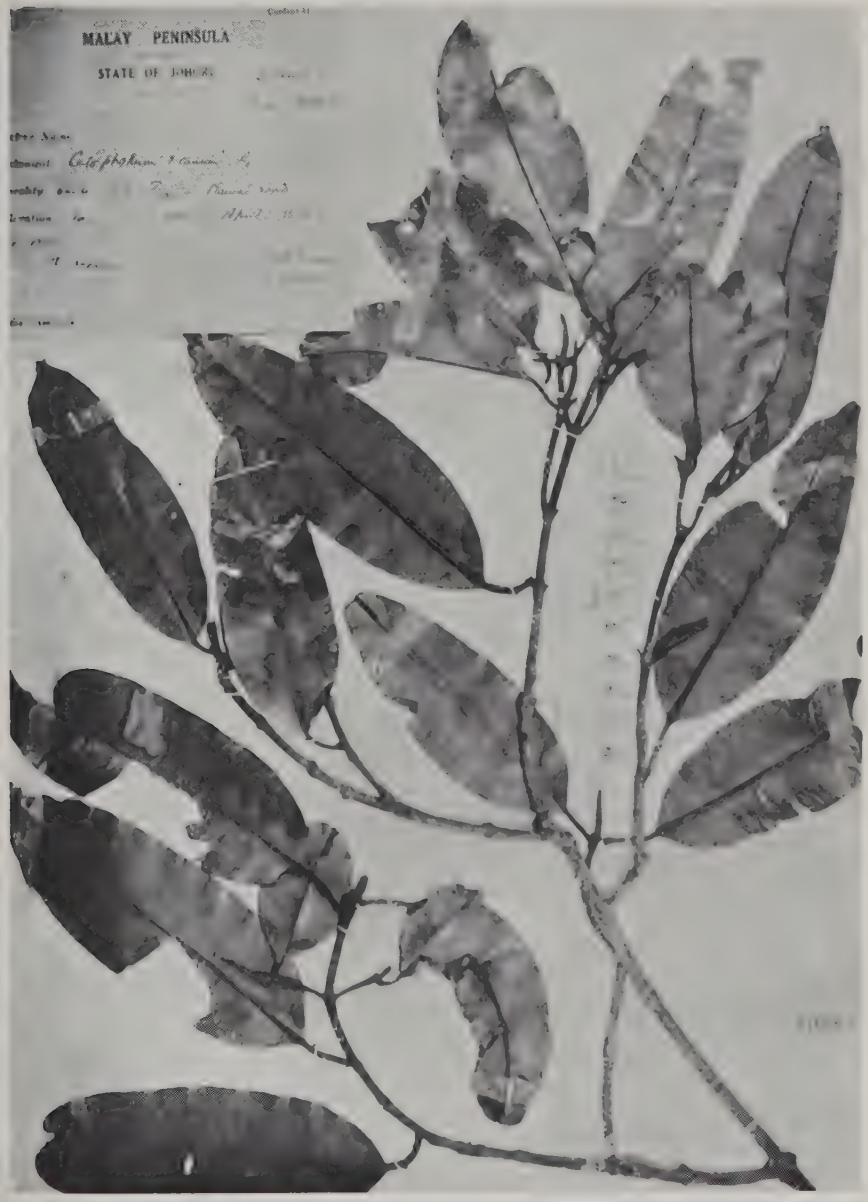

Plate III. Calophyllum wallichianum *Pl. & Tri.* (S.F.N. 30987).

Plate IV. Calophyllum tahanense *Hend. & W.-S.* (Corner s.n., 11-9-37).

Plate V. Calophyllum rubiginosum *Hend. & W.-S.* (Kep. 10470).

Plate VI. Calophyllum flavo-ramulum *Hend. & W.-S.* (Kep. 4198).

Plate VII. Calophyllum tenuivenium *Hend. & W.-S.* (S.F.N. 32274, type collection).

Plate VIII. Calophyllum sp. No. 10. (S.F.N. 29969).

Plate IX. Calophyllum inophylloide *King* var. singapurense *Hend. & W.-S.* (S.F.N. 34644).

Plate X. Calophyllum coriaceum *Hend. & W.-S.* (Kep. 13627, type collection).

Plate XI. Calophyllum subhorizontale *Hend. & W.-S.* (Kep. 5315).

Plate XII. Calophyllum scriblitifolium *Hend. & W.-S.* (Kep. 70211).

Plate XIII. Calophyllum sp. No. 23. (Kep. 71317).

Plate XIV. Calophyllum ferrugineum *Ridl.* (S.F.N. 35797).

Plate XV. Calophyllum retusum *Wall.* (Kep. 70194).

Plate XVI. Calophyllum floribundum *Hook. f.* (Singapore Gardens 1691).

Plate XVII. Calophyllum depressinervosum *Hend. & W.-S.* (Curtis 830, type collection).

Plate XVIII. Calophyllum symingtonianum *Hend. & W.-S.* (S.F.N. 32633, type collection).

Plate XIX. Calophyllum cuneatum *Hend. & W.-S.* (S.F.N. 31232, type collection).

Plate XX. Calophyllum aureum *Hend. & W.-S.* (Kep. 31007, type collection).

Plate XXI. Calophyllum aureo-brunnescens *Hend. & W.-S.* (Wray & Robinson 5340).

Plate XXII. Calophyllum intramarginale *Hend. & W.-S.* (S.F.N. 31900, type collection).

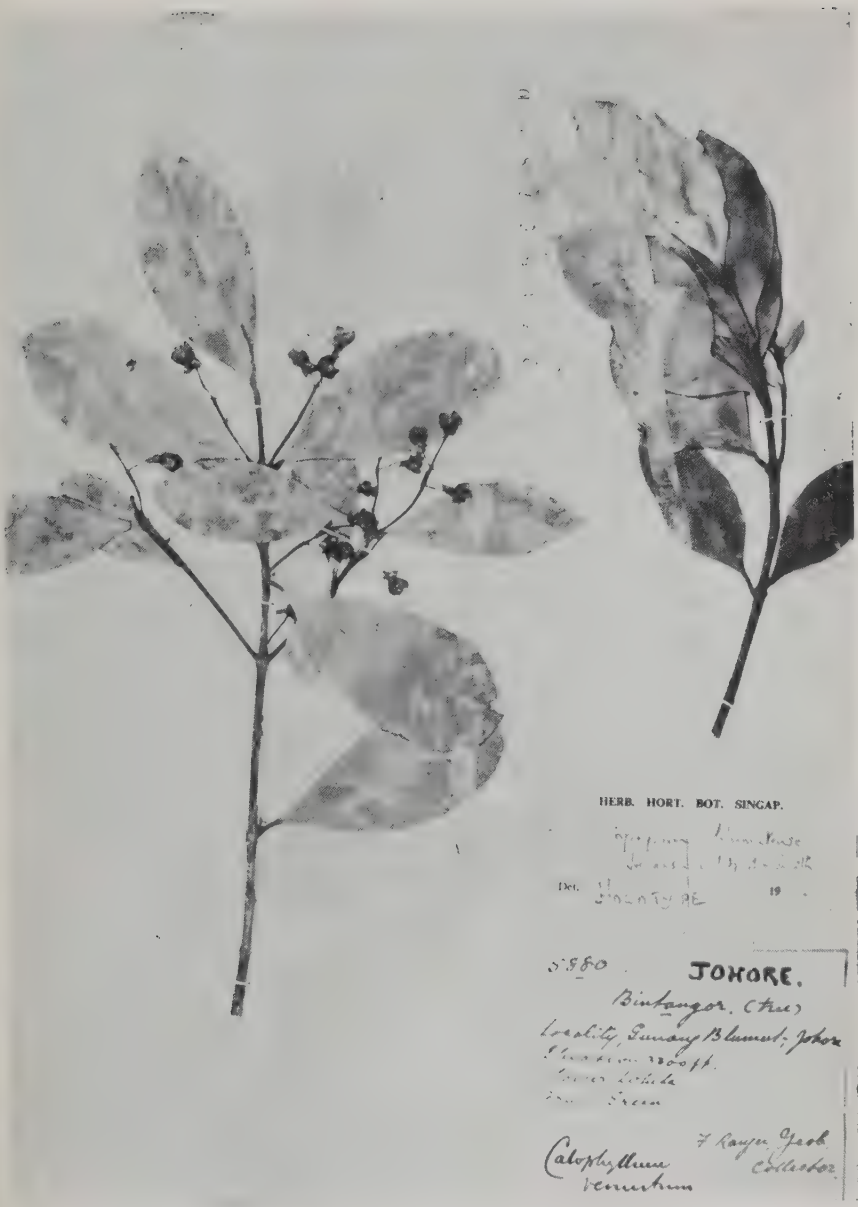

Plate XXIII. Calophyllum blumutense *Hend. & W.-S.* (Kep. 5880, type collection).

Plate XXIV. Calophyllum fraseri *Hend. & W.-S.* (S.F.N. 11282, type collection).

Plate XXV. Calophyllum fraseri *Hend. & W.-S.* (S.F.N. 31878).

Plate XXVI. Calophyllum costulatum *Hend. & W.-S.* (Ridley 6332, type collection).

Plate XXVII. Calophyllum rupicolum var. (S.F.N. 34747).

Plate XXVIII. Calophyllum gracillimum *Hend. & W.-S.* (Kep. 2715, type collection).

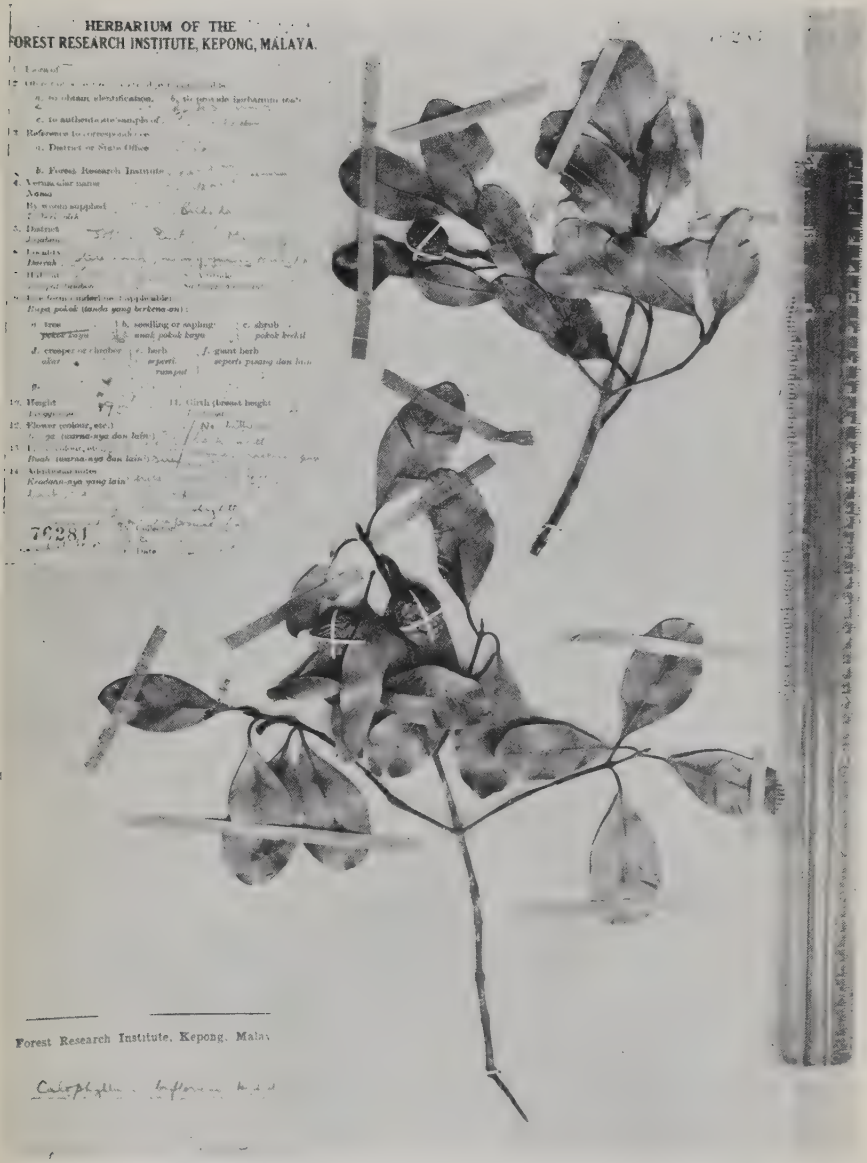

Plate XXIX. Calophyllum biflorum *Hend. & W.-S.* (Kep. 76281).

Plate XXX. Calophyllum sp. No. 44 (Corner s.n., 30-4-34).

Plate XXXI. Calophyllum sp. No. 45. (Kep. 59624).

Plate XXXII. Calophyllum enervosum *Hend. & W.-S.* (Kep. 71894, type collection).

MISCELLANEOUS FIELD NOTES

Species (Species known to reach timber size (4 ft. g. b. h.) in heavy print; *C. rupicolum* (No. 41) is a bush)	Habitat: Montane and tops of isolated hills	Habitat: Coastal hills and hill forest	Habitat: Lowland forest	Habitat: Peat swamp forest	Habitat: Freshwater swamp	Habitat: Riparian	Habitat: Beach	Buttresses, etc.: Stilt and adventitious roots	Buttresses, etc.: Knee roots	Buttresses, etc.: Buttressed	Bark (Varies considerably in a species with age, size and current rate of growth of tree)	Exudate (Exudate is sticky unless otherwise stated)
1. **C. incrassatum**			L		F (g)						Smooth to shallow fissured	White turning yellow on exposure
2. **C. wallichianum**		C	L								Irregularly fissured	White turning yellow cream on exposure. Occasionally clear golden
3. *C. tahanense*	M										Rough, lightly fissured	—
4. **C. canum**			L								Smooth with boat-shaped fissures	Clear yellow brown
5. *C. molle*			L								Smooth with very fine fissures	Clear golden
6. **C. rubiginosum (a)**			L								Smooth with fine fissures	White
7. *C. flavo-ramulum*			L								Shallow or deep coarsely fissured	Clear golden
8. *C. tenuivenium*			L		F						Slightly fissured	Yellow
9. *C. griffithii*			L								—	—
10. *C. sp. No. 10*	M										—	—
11. **C. inophyllum (b)**							B				Smooth with boat-shaped fissures	Clear golden yellow
12. **C. inophylloide**		C	L		F (h)			S		B	Rough shallow fissured	Clear lemon yellow
13. **C. inophylloide var. singapurense**			L					S		B	Rough shallow fissured	Clear yellow to yellow brown, varnish-like, non-sticky
14. *C. macrocarpum*			L (e)			R					Coarsely deeply fissured	Yellow
15. *C. javanicum*					F				K		Rough shallow fissured	Cloudy golden
16. *C. soulattri*						R					Smooth	Creamy white; watery becoming sticky on exposure
17. *C. kunstleri*			L		F (g)				K (g)		Smooth shallow fissured	Yellowish brown, watery, jelly-like
18. **C. curtisii**			L								Smooth boat-shaped to rugose fissured	Clear golden
19. **C. coriaceum (b)**	M				F						Rough coarsely fissured	White
20. **C. sclerophyllum**								S	K		Shallow fissured	Clear golden
21. *C. subhorizontale*			L								—	Yellow
22. **C. scriblitifolium**				P (g)	F						Coarsely fissured	Yellowish cream
23. **C. sp. No. 23**			L (e)		F					B	Smooth with fine fissures	Saffron yellow
24. **C. ferrugineum (a)**			L								Smooth with boat-shaped fissures	Clear golden
25. **C. ferrugineum var. nerifolium (a)**			L								Smooth with boat-shaped fissures	Colourless or clear pale brown
26. **C. retusum**				P	F (g)						Smooth with boat-shaped fissures	Clear yellowish or amber
27. **C. floribundum**	M	C	L							B	Smooth with boat-shaped fissures	Clear yellow or golden
28. **C. pulcherrimum (a)**			L								Smooth	Clear golden
29. **C. depressinervosum**			L								Smooth with diamond shaped fissures	Clear golden
30. *C. nodosum*	M (c)										—	—
31. *C. rotundifolium*	M										—	—
32. **C. symingtonianum (b)**	M	C (g)									Rough coarsely fissured	Clear almost colourless
33. **C. cuneatum (b)**	M										Slightly fissured	Whitish
34. *C. aureum*	M										Smooth	Golden
35. *C. aureo-brunnescens*	M										—	—
36. *C. intramarginale*	M										Shallow fissured	Yellow
37. *C. blumutense*	M										—	—
38. *C. fraseri*	M										Smooth	Pale yellow, non-sticky, varnish-like
39. *C. costulatum*											—	—
40. *C. pisiferum*											—	—
41. *C. rupicolum*						R					Slightly rough	Cloudy canary yellow
C. rupicolum var. (a)						R					Slightly rough	Milky yellow
42. *C. singuliflorum*			L		F (g)						Smooth	White
43. *C. bifforum*		C (d)	L				B (g)				Smooth to coarsely fissured	White to cream coloured
44. *C. sp. No. 44*			L			R		S	K		Smooth to shallow rugose fissured	Yellow, watery
45. *C. sp. No. 45*			L								Smooth slightly fissured	Yellow
46. **C. enervosum**			L								Smooth	Clear colourless turning cloudy pale brown on exposure

Species (Species known to reach timber size (4 ft. g. b. h.) in heavy print; *C. rupicolum* (No. 41) is a bush)	Leaf (For shape and size of lamina see figures): Texture (Very coriaceous..XXXX coriaceous..XXX sub-coriaceous..XX thinly coriaceous..X)	Leaf: Hairiness on under surface	Leaf: Petiole length (1 m. or more..L ¼ m. or less..S)	Leaf: Miscellaneous	Terminal Buds: Length (1 m. or more..L ¼ m. or less..S)	Terminal Buds: Miscellaneous (only those strikingly tomentose indicated)
1. **C. incrassatum**	XXX	Midrib white (g)	L	—	L	Curved (f), narrow, pointed
2. **C. wallichianum**	XXX	Midrib rufous	L (g)	—	L (h)	Cylindrical, often waisted at base
3. *C. tahanense*	XXXX	—	L	—	L (h)	Narrow, pointed
4. **C. canum**	XX	—	—	Lamina upper surface shiny dark red brown	—	Narrow, restricted midway
5. *C. molle*	XX	Generally	—	—	—	Narrowly oblong-ovate, densely tomentose
6. **C. rubiginosum (a)**	XX—XXX	Finely rusty	L (g)	—	—	Narrow, abruptly pointed
7. *C. flavo-ramulum*	XX—XXX	Midrib fine red	—	—	S	Sharply pointed
8. *C. tenuivenium*	X	—	—	—	S	Narrow, pointed
9. *C. griffithii*	XX	—	—	—	S	Pyramidal
10. *C. sp. No. 10*	XXXX	—	L (h)	—	—	Stout, lanceolate acute
11. **C. inophyllum (b)**	XX	—	—	—	S (f)	Triangular
12. **C. inophylloide**	XXX—XXXX	—	—	Thickened margin	—	Narrow
13. **C. inophylloide var. singapurense**	XXX	Petiole and midrib slightly rusty brown (g)	—	—	S	Narrow
14. *C. macrocarpum*	XX	—	L	—	S	Pointed
15. *C. javanicum*	X—XX	—	S	Cordate base; almost sessile	S	Narrow, flattened; almost white
16. *C. soulattri*	X	—	—	—	—	Narrow, pointed
17. *C. kunstleri*	XX—XXX	—	—	Very oblique venation	S (g)	Narrow, pointed; extra-axillary buds (f)
18. **C. curtisii**	XX	—	—	—	S (f)	Narrow, pointed
19. **C. coriaceum (b)**	XXXX	—	L (h)	Thickened margin	L (h)	Pointed
20. **C. sclerophyllum**	XXXX	—	—	Thickened margin	—	Conical
21. *C. subhorizontale*	X—XX	—	—	Thickened margin	S	Stout
22. **C. scriblitifolium**	XXXX	—	L (h)	Revolute; thickened margin	L	Narrowly lanceolate
23. **C. sp. No. 23**	X	—	L	Slightly revolute thickened margin	—	Narrowly ovate acuminate
24. **C. ferrugineum (a)**	XX—XXX	Midrib red	—	Upper surface often slightly glaucous. Slight ridges alongside midrib on lower face of dried leaf	S	Bluntly pointed; densely tomentose
25. **C. ferrugineum var. nerifolium (a)**	XX—XXX	—	—	Slight ridges alongside midrib on lower face of dried leafs	S	Pointed
26. **C. retusum**	XXX—XXXX	—	—	Upper surface often glaucous. Fallen leaf rich red brown	—	Narrow, pointed
27. **C. floribundum**	X	—	S (f)	Margin slightly thickened and pale in colour	S	Stoutish, pointed
28. **C. pulcherrimum (a)**	X—XX	—	—	Midrib channelled on lower face. Margin pale in colour	S	Narrow, abruptly pointed
29. **C. depressinervosum**	X	—	—	Midrib channelled on lower face	S	Very small, bluntly pointed
30. *C. nodosum*	X—XX	—	S	—	S	Narrow, bluntly pointed
31. *C. rotundifolium*	XXX	—	—	Cordate base; almost sessile	?	—
32. **C. symingtonianum (b)**	XX	—	—	—	—	Very slender, pointed
33. **C. cuneatum (b)**	XXX	—	S (f)	—	S	Stoutish, pointed
34. *C. aureum*	XXX	—	—	—	—	Slender
35. *C. aureo-brunnescens*	XXX	—	—	—	—	Very slender, pointed
36. *C. intramarginale*	XXX—XXXX	—	—	Obscure intra-marginal vein	—	Very slender, pointed
37. *C. blumutense*	XX	—	S (f)	Pale thickened margin	S	Narrow, pointed
38. *C. fraseri*	XXX	—	—	—	S	Stoutish, pointed
39. *C. costulatum*	XXX—XXXX	Midrib sparsely	S	Thickened margin	S	Narrowly conical, pointed
40. *C. pisiferum*	X	—	S	—	S	Narrowly conical, pointed; densely red tomentose
41. *C. rupicolum*	X	—	S	—	S	Narrow, pointed
C. rupicolum var. (a)	X	Midrib slightly fugaciously reddish	S	—	S	Narrowly conical, pointed
42. *C. singuliflorum*	X	—	S	—	S	Cylindrical, blunt, reddish hairy
43. *C. bifforum*	XX	—	—	—	S	Cylindrical, blunt, densely red tomentose
44. *C. sp. No. 44*	X—XX	—	S (f)	—	S	Cylindrical, blunt, densely red tomentose
45. *C. sp. No. 45*	X	—	S	—	S	Narrow, slender
46. **C. enervosum**	XXX—XXXX	—	S (g)	Margin and midrib very pale; petiole yellow	S	Stout

Species (Species known to reach timber size (4 ft. g. b. h.) in heavy print; *C. rupicolum* (No. 41) is a bush)	Fruit: Size (in cms.)	Fruit: Shape	Fruit: Nature of Coat (when dry)	Miscellaneous (only striking features included, e.g. most young twigs are angular and have some tomentum)
1. **C. incrassatum**	3 diam.	Oblong-globose or ellipsoid, apiculate	Thick, faintly wrinkled	—
2. **C. wallichianum**	4.5×3.5	Globose to elliptic-obovoid	Thick, wrinkled	Young twigs ferruginous tomentose
3. *C. tahanense*	3×2.5	Globose—broadly ellipsoid, umbonate	Thick, finely wrinkled	—
4. **C. canum**	2.5 diam.	Ellipsoid to globose	Thick, wrinkled	—
5. *C. molle*	2.5 long	Globose-ellipsoid, shortly apiculate	Thick, shallowly wrinkled	Young twigs ferruginous tomentose; twigs pale yellow grey.
6. **C. rubiginosum (a)**	2.5 long	Ovoid-ellipsoid, beaked	Rather thick, coarsely hairy wrinkled	Young twigs fine rusty tomentose; twigs yellowish to white.
7. *C. flavo-ramulum*	2 long	Globular or ellipsoid	Rather thick, almost smooth	Twigs pale yellow to white; fallen leaves boat-shaped.
8. *C. tenuivenium*	—	—	—	Twigs pale fawn or biscuit coloured.
9. *C. griffithii*	—	—	—	Young twigs strongly 4-angled.
10. *C. sp. No. 10*	2.5 long	Ellipsoid to globose slightly pointed	Thick, finely wrinkled	Young twigs strongly 4-angled.
11. **C. inophyllum (b)**	3–4 diam.	Globose	Thick, wrinkled	—
12. **C. inophylloide**	2 long	Ovoid-globose	Thick, smooth	—
13. **C. inophylloide var. singapurense**	2.8×2	Sub-globose, slightly pointed	Thick, slightly rough	—
14. *C. macrocarpum*	14×7	Ellipsoid-ovoid	Outer thin; inner fibrous, thick	Twigs strongly angled, almost winged.
15. *C. javanicum*	2.5 diam.	Globose	Wrinkled	Young twigs yellow, strongly 4-angled.
16. *C. soulattri*	—	Globose	Thick smooth	—
17. *C. kunstleri*	1–1.5 diam.	Globose	Rather thick, wrinkled	Extra-axillary buds.
18. **C. curtisii**	1.2 diam.	Globose	Thin, smooth brittle	Ultimate twigs characteristically branched in threes.
19. **C. coriaceum (b)**	4×2	Ellipsoid, beaked	Thick wrinkled	—
20. **C. sclerophyllum**	3 diam.	Globose	Very thick, finely wrinkled	Twigs strongly angular; petiole stout flattened.
21. *C. subhorizontale*	4 long	Ovoid-acute	Thin crustaceous, wrinkled	—
22. **C. scriblitifolium**	2.2×1.5	Oblong-globose, umbonate	Thick, smooth	—
23. **C. sp. No. 23**	—	—	—	Twigs pale grey.
24. **C. ferrugineum (a)**	3 long	Ellipsoid	Thin crustaceous wrinkled	—
25. **C. ferrugineum var. nerifolium (a)**	2.5 long	Oblong	Thin, brittle wrinkled	
26. **C. retusum**	2×1.5	Oblong to globose	Rather thick, faintly wrinkled	—
27. **C. floribundum**	2.5 long	Broadly ellipsoid to globose	Thin, brittle, smooth	—
28. **C. pulcherrimum (a)**	2 long	Ovoid ellipsoid, acutely beaked	Thick, hard, closely wrinkled brittle, smooth	—
29. **C. depressinervosum**	0.9 diam.	Globose	Thin, brittle, smooth	—
30. *C. nodosum*	1 long	Ellipsoid or globose	Thin wrinkled	—
31. *C. rotundifolium*	—	—	—	—
32. **C. symingtonianum (b)**	3×2.5	Ellipsoid to slightly obovoid	Thick, hardish finely wrinkled	—
33. **C. cuneatum (b)**	1 diam.	Globose	Rather thin, wrinkled	—
34. *C. aureum*	—	Globose	Thick, almost smooth	—
35. *C. aureo-brunnescens*	—	—	—	—
36. *C. intramarginale*	2.5×2	Sub-globose, slightly pointed	Thick, smooth	—
37. *C. blumutense*	1.5 long	Ellipsoid	Thin, brittle, smooth	—
38. *C. fraseri*	2×1.3	Ellipsoid	Hard, finely wrinkled	—
39. *C. costulatum*	—	—	—	Twigs yellowish.
40. *C. pisiferum*	0.7–0.8 diam.	Globose	Thin, brittle, wrinkled	Twigs tomentose, grey.
41. *C. rupicolum*	0.9 long	Elliptic globose, minutely apiculate	Thin, brittle, nearly smooth	Young twigs strongly 4-angled. Bush.
C. rupicolum var. (a)	1×0.8	Ovoid, globose, apiculate	Thin, wrinkled	Young twigs strongly 4-angled.
42. *C. singuliflorum*	1.2 diam.	Globose	Thick, finely wrinkled	Twigs pale yellow, often nearly white.
43. *C. bifforum*	2×1.75	Globose	Thin, brittle, wrinkled	—
44. *C. sp. No. 44*	—	—	—	—
45. *C. sp. No. 45*	1.5 diam.	Globose	Thin, brittle, smooth	Twigs very slender, almost white.
46. **C. enervosum**	—	—	—	Young twigs pale grey or yellow.

Footnotes:

a not recorded over 5 feet in girth at breast height.
b boles usually short.
c hills only.
d rocky coast.
e usually low-lying.
f frequently.
g occasionally.
h rare.

BOOK REVIEW

Forest Trees of Sarawak and Brunei and their Products by F. G. Browne, B.Sc., Conservator of Forests, Sarawak. Printed at the Government Printing Office, Kuching, Sarawak, 1955—369 pages and 48 photographs. Price 12 Malayan dollars.

This book will be a welcome and useful asset to foresters and timbermen and also to teachers and others who want to know something of the native trees of Sarawak and Brunei. Indeed, there is no flora or manual on this subject, the existing publications are scattered in various scientific journals, many of which are rare or out of print, and which often describe only one or a few species of a particular group. The present work deals primarily with a large number of trees of economic importance, and fortunately, as well, with others of no special value but which are so conspicuous in a forest that one naturally wants to know what they are and thus a better general picture of the diversity and characters of plant families is framed. A book of this size cannot be exhaustive since there are some 3,000 tree species in the area concerned; it is not intended to be a flora nor a work for the serious taxonomist. Although a systematic botanist will not be able to 'key down' every species he meets, or even half of them, he has much to learn from it in the way of certain useful characters and information which will not be found in any other publication. These, if remembered, will often give him good diagnostic clues to a particular species even if the local vernacular name alone is known to him. The book is excellent for vernacular names, many of which are different from the equivalent Malay name and which cannot be found in most existing publications.

The most pleasing thing about the book is that the descriptions and observations are the author's own, made from the living tree and are not merely copied from other works of reference. There is also much interesting information on the economic uses of timbers and the ecological and biological aspects of certain species and the part they play in Dyak legends and folk-lore. The book can also be recommended for the excellent descriptions of bark characters which a systematic botanist so often looks in vain for on collector's labels and in past literature and publications.

There are two keys, a larger one based on bark, crown, bole and leaf characters but not including those of flowers or fruit, and a smaller one for wood sections. The former is for use in the field

since bark slashes have to be made and the general appearance of the tree noted. It is a pity that more stress has not been placed on floral characters and that some use of them had not been made in the key. The author says that little attention need be paid to flowers, which are rarely seen, and are generally not of much use for field identification when they are. This sort of statement is apt to discourage foresters and others from taking any notice or further interest in them. Quite often two closely related species have similar leaves but the flowers are the only safe guides to distinguish between them. For example the leaves of *Melanorrhoea wallichii* and *M. woodsiana* are very similar but the former has white petals while in the latter they are white with a yellow streak on the basal third of the inside. Further there is all the helpful difference in the world between a gamopetalous corolla and a sympetalous one. On the question of botanical names a little criticism might be useful. The only serious case was in connection with *Planchonella obovata* H. J. Lam, where H. J. Lam is not the author and has nothing to do with this species as far as nomenclature is concerned. It should be *Planchonella obovata* (R.Br.) Pierre. Sometimes in combinations one of the authors names is omitted, e.g. *Thespesia populnea* (*L.*) Soland ex *Corr.*; *Xylopia ferruginea* (*Hk. f. et Th.*) Hk. f. et Th.; *Antiaris toxicaria* (*Pers.*) Lesch.; *Arenga pinnata* (*Wurmb.*) Merr. and *Cantleya corniculata* (Becc.) *Howard* where the underlined author's name is left out. *Vitex perolata* King is now *Teijsmanniodendron pteropodum* (Miq.) Bakh. and *Bruguiera eriopetala* W. et A. is *B. sexangulare* (Lour.) Poir. *Pongamia pinnata* (L.) Merr. should be (L.) Pierre and *Oncosperma tigillarium* (Jack) Ridley will replace the synonym *Oncosperma filamentosa* Bl. *Oncosperma* is neuter and *O. horrida* Scheff. will be *O. horridum* (Griff.) Scheff., the specific epithet ending in *um* in both cases.

The photographs, unfortunately are not up to the standard of the text. Many of them are disappointing and are not typical of the tree depicted. In fact, one must often fail to identity the tree they propose to represent, indeed, if they are intended for such a purpose. For example the one of *Dyera lowii* opposite page 72 could easily pass for a Rubber tree; the plate of *Fagraea fragrans* opposite 248 is merely a mass of dense foliage and shows nothing of the very characteristic bark of that species. *Melaleuca leucadendron*, opposite page 272 could be almost any other tree; *Rhizophora mucronata* opposite page 312 could pass for a *Dillenia*. The plate of *Angsana* opposite page 240, although it may show the general outline, will convey little to a person who is not

already acquainted with it. It would have been better if a part of the space in the plate had been reserved for a drawing of a few leaves and the very characteristic round pod. The same may be said for the other plates. A clear drawing of a single leaf or a leafy twig would have been more useful than a dim *ombrage* of foliage. The expression 'different kinds of tree' used several times, may not be pleasing to everyone.

However, finally, and apart from these minor points of criticism, the general 'set up' of the book with the nice, large, easily readable type and the excellent binding in grey imitation lizard skin all for twelve dollars, is good value.

J.S.

THE GARDEN'S BULLETIN

SINGAPORE

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